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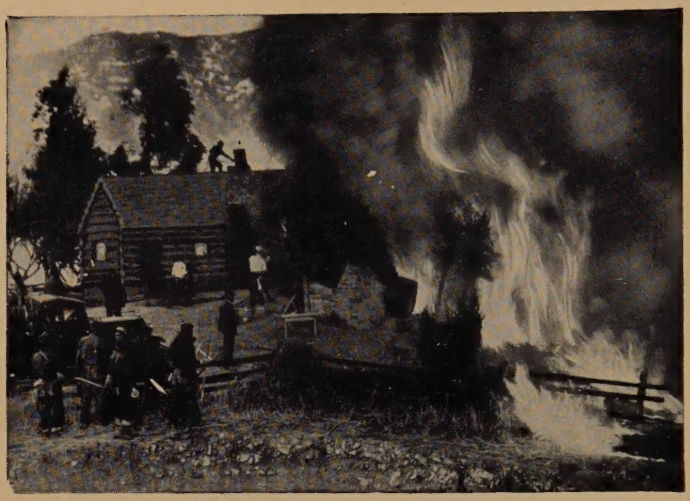

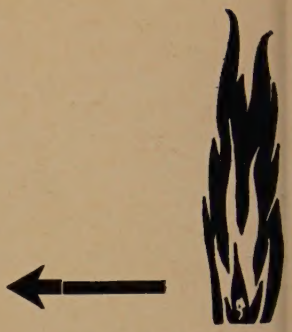

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JOURNAL OF FORESTRY

VOL. 34 MAY, 1936 No. 5

EDITORIAL

THE PROSPECTS FOR PUBLIC-PRIVATE ORGANIZED COOPERATION

BEFORE the present issue of the JOURNAL is off the press, a showdown will presumably have been reached on what the lumber industry wants to do toward maintaining the organized cooperation between public and private agencies which originated from the Lumber Code. The cooperative purpose has been the advancement and extension of private forestry practices; its objective, the substitution of forest conservation for forest destruction on a Nation-wide basis. The question arises, how useful to the forest industries and how serviceable to the public welfare continued cooperation gives reasonable promise of becoming if adequately supported and far-sightedly conducted. A swift review of the history of this cooperation, its present form of organization, and the kind of things it has worked for may make the task of evaluation easier.

* * * *

For close to twenty years the organized lumber industry has felt a definite need of helpful legislation. For much longer than that, indeed, lumbermen have been reiterating that tax laws ought to be modified in their favor. But in the second decade of the present century the industry began to be embarrassed by a buyers' market. The business panic of 1907 had, it was gradually revealed, signalized the turn of the tide in lumber consumption in the United States. From its peak of 45.6 billion board feet in 1907 consumption had fallen by 1918 to 32 billion. The industry, loaded up with stumpage acquired on the assumption of an ever-expanding market (an assumption justified by the entire history of lumbering in the United States prior to 1907), and with its stumpage often capitalized at fancy prices, was unable to adjust production to demand.

At the same time it found itself, to its astonishment and indignation, an object of severe public criticism for its destructive exploitation of the Nation's forest resources. As if this were not enough and more than enough, it was charged with timber monopoly, and on top of that, with trade practices aimed at market control in violation of the anti-trust laws. The Clayton Act and the establishment of the Federal Trade Commission had put more teeth in these laws. And the threat of public regulation to compel practices of conservation, definitely sought during Theodore Roosevelt's presidency, was still in the air, like the mutterings of distant thunder after a storm which might return. Hard beset, the industry began to plan earnestly to obtain some measure of relief through public assistance.

Eventually it became manifest that the

best promise of relief lay in a form of public-private cooperation which would suitably recognize both the public ends to be sought and the practical requirements of the industry for permanent efficient functioning. The National Industrial Recovery Act suddenly opened an unexpected and new avenue of opportunity.

Under its general objectives for all industries, the N.I.R.A., or administrative organization for giving effect to the Act, sought increased wages and decreased hours of labor, balanced against provision for a certain measure of market stabilization to permit profitable operations. Unfair trade practices were to be prohibited, and certain powers of self-government were to be conferred upon industry for production control, with the backing of federal authority to enforce compliance. For the lumber and timber products industries a further public objective was formulated—the adoption of forest conservation practices. This was embodied in Article X of the Lumber Code, under which the applicant industries definitely recognized a public obligation to conserve forest growth in return for the public cooperation extended through the Act.

There were definite potential advantages for these industries in undertaking to operate on a basis of forest conservation —better public esteem, an aid to stabilization, a guarantee of permanent life. On the other hand, the industry insisted that to succeed in its undertaking of forest conservation it must have more than the power to bring its production into balance with market requirements; it must also have certain specified forms of public assistance—better tax laws, more protection at public cost against fire, insects, and tree diseases, more public research, better credit facilities, and a lightening of the burden of unprofitable timber holdings through an enlarged public acquisition policy.

The Lumber Code, adopted in the summer of 1933, not only pledged the participating lumber and timber products industries to apply woods practices that would leave cut-over lands in suitable condition for regrowth; it definitely had in view also going forward as far and as fast as practically possible toward the permanent management of commercial forests for sustained yield. But it was insisted by the industry that the rate of progress toward this goal necessarily depended upon substantial public cooperation to lessen the hampering obstacles. To effectuate the needed cooperation a joint conference was convened by the Secretary of Agriculture in the fall of 1933. It drew up a tentative conservation program, and adjourned to give opportunity for discussion of the proposals by the regional agencies of the lumber industry.

Three months later the conference was reconvened and adopted a final program. This called for definite coordinated measures, public and private, designed to bring about the cessation of destructive practices in private lumber operations, in favor of practices that would conserve the forests as a permanent, wisely used resource. Further, a continuing joint committee was set up, representing equally the private and the public and quasi-public agencies participating in the conference, to serve as a means of advancing the integrated public and private program of action.

This joint committee survived the demise of the Lumber Code. It implements the declared purpose of the lumber industry to continue the effort to make conservative forestry practices basic in industrial forest utilization. The committee meets from time to time, to formulate such further courses of action as the developing situation seems to call for.

The National Lumber Manufacturers' Association had been the spearhead of the industrial effort to obtain a working

agreement between public and private agencies on what is feasible through joint effort. The question of the worthwhileness of continued effort in this field, and of the industrial backing to be given it during the coming year, will be before the Association at its annual meeting in Chicago April 23-25. Probably the determining matter will be the appraisal by lumbermen of the prospective advantages for their industry that the work of a suitably equipped committee promises.

Hitherto, the joint committee has been concerned mainly with formulating and furthering a program of federal legislation agreed upon as desirable in the interest of industrial forestry. In the April JOURNAL the latest proposals of the committee, as embodied in "A bill to promote sustained yield forest management," were summarized. That the obtaining of legislation sought by the industry and recognized by the public forestry agencies as calculated to advance the public welfare can be greatly facilitated by joint advocacy seems a truism. For this reason alone, it would seem that a continuance of support for the committee from industrial sources might be looked for. But additional and perhaps more weighty reasons can be advanced for wanting the committee to be kept functioning as vigorously as possible.

It is true that there are wide differences of opinion amongst foresters regarding the importance of maintaining an agency through which the governmental organizations concerned with forestry—federal and state—and the forest industries may jointly study the field of helpful cooperative effort, constructively work out its possibilities, and unite to bring about the realization of these possibilities. In the eyes of some, public ownership and administration looms up as almost the sole dependence for bringing about the practice of large-scale forestry. Others look with distrust and fear on the proposals for rapidly increasing public ownership. The Atlanta meeting of the Society brought out forcibly how divided is the thought within our profession on the question of public versus private forest management. Looked at practically, however, the situation seems hardly to justify the amount of commotion that the subject has stirred up. Why versus? Why not both? Is that not what in point of fact we are going to have, in any case, for a long time? If so, any means that affords promise of developing genuine effectiveness for promoting the spread of private forestry deserves hearty backing.

Relationships of mutual hostility and distrust between public and private agencies are beneficial to nobody. It is much better to be able to discuss differences across the table in a spirit of fact-facing, of negotiation, and of mutual understanding; and beyond that, to seek out constructively the fullest possible field for sound cooperation. In this issue of the JOURNAL (page 534) Mr. Woods has quoted from a significant address of the Secretary-Manager of the Southern Pine Association, in which much stress was laid on the conception of an industry convinced of its own permanence and shaping its course on the basis of permanence—in other words, on the basis of forestry. To the extent that the industry accepts this conception not primarily for window-dressing but as a wholehearted belief, there is the strongest reason for endeavoring to provide means of cooperation and for endeavoring to make this cooperation more effective. It is to be hoped that continued and vigorous support of the joint committee will eventuate from the Chicago meeting of the National Lumber Manufacturers' Association.

DEER AND DAUERWALD IN GERMANY
II. ECOLOGY AND POLICY

By ALDO LEOPOLD

University of Wisconsin

IN THE preceding paper we have traced through a period of nine centuries the slow but inexorable growth of a system of silviculture incompatible with a natural and healthy game stand, and of a system of game management incompatible with a natural and healthy silviculture. We have also traced the new movement, called Dauerwald, which aims to bring about a mutual reform. We have sketched the difficulties and delays which impede its realization.

We have now to deal with the ecological evidence of this conflict, the human motives involved, and the lessons which American game managers and foresters may draw from Germany's experience.

Ecology

The present nature and trend of the conflict between deer and forestry can, of course, be inferred from the vegetative evidence alone, without recourse to historical data. The most reliable evidence for cursory inspection is the low woody vegetation, which records the grazing pressure not only in its composition as to species but also in the configuration of its browsed stems.

Table 1 presents a list of German deer browse species arranged in a descending sequence of palatability. The ratings are based on my own observations and on the off-hand opinions of German foresters. They seem to check substantially with Eck's pamphlet on browse plants, but he does not attempt to set up any sequence.

When such a table is compared with the actual feed on the ground, it is apparent at once that *preferred browse foods* (Class I) *no longer occur in deer forests* except under fence, although most are common enough in detached deerless woodlots. In deer forests even the staples (Class II) are often scarce or absent, while the emergency foods (Class III) show browsing, sometimes even summer browsing.

Conversely, the "stuffing" species are common wherever the prevailing silviculture allows enough light. They occupy the space in which the better foods should grow.

Such evidence, when it holds consistently for dozens of scattered localities, admits but of one interpretation: the palatable species have been run out by deer, and by the prevailing system of silviculture.

Why Foodless?—It is highly important that the mechanism of this interaction between deer and silviculture be understood. Palatable foods are, as a rule, intolerants. A stand of pure spruce, after the crowns have once closed, admits no green living thing to grow in its shade except moss. On "sick soils" where raw duff has accumulated, not even moss can subsist. The forest floor is an ecological desert bare of all macroscopic life (and now soil science finds that even its microscopic flora is impoverished). Under the prevailing 100-year rotation, followed by artificial reproduction which closes at 10 years, only 10 per cent of such a forest can, at any one time, be stocked with deer food plants, even where

a seed stock of such food plants still exists.

If now, by artificial winter feeding and predator control and fencing, an abnormal density of deer be maintained in such a nearly foodless woods, it is easily seen how *an intolerable pressure is brought to bear against all palatable plants*, and how, in the course of time, they have been eradicated from the deer ranges. It is also clear that such eradication is the result not of deer alone, nor of silviculture alone, but of an active and mutually destructive interaction between the two.

In spruce with natural reproduction the situation is ameliorated to the extent of an additional 10-year period of preparatory thinnings. In such a forest perhaps 20 per cent of the forest area might bear feed, consisting half of thinned mature spruce, and half of reproduction the crowns of which have not yet closed.

In pine the vicious cycle is milder, in that a few tolerant emergency foods such as heather, juniper, blueberry, and bracken can exist under the older stands. The intolerant preferred and staple foods, however, are equally conspicuous by their absence from pure pine in Germany.

The percentage of feed-bearing area in a mixed selection forest is hard to estimate, due to its dispersion in many small patches. If artificial pure spruce has a possible 10 per cent, and natural spruce 20 per cent, I would estimate mixed selection forest to have a possible 33 per cent in food-bearing plants.

Some of the expropriated palatables are of special interest. Yew, for example, is now virtually extinct as a wild plant, whereas early records show that the Nürnberg region, and probably other parts of Germany, once supported a thriving trade exporting yew bowstaves to England. It must have been plentiful at that time. E. E. Carter tells me that a working plan for the forest of Justingen, in Württemberg, written in 1865, mentions that "Taxus is to be preserved wherever it will come in." Now, however, the species is absent. I saw one yew plantation, made from seeds distributed by a "Naturschutz" society, but the deer were eating it up. Some German foresters think yew succumbed to the bowstave trade, but to those who know what a small percentage of yew trees contain any staves, this sounds unlikely. I think a more plausible hypothesis is that deer have prevented reproduction.

The expropriation of palatable woody browse plants must be paralleled by a similar expropriation of palatable herbs and annuals, but since many herbs are invisible at certain seasons, and since the pressure on nonwoody plants is not "self-recording," as in the nipped stems of browse, the field evidence cannot be accurately read by one visiting the country for only a single season. It may not be amiss to remark, however, that on clear cuttings in both pine and spruce I repeatedly noted a visible shrub and herb flora comprising only five species, whereas on nearby check areas accidentally protected by railroads or creek bends I noted as high as sixteen species. This indicates an impoverishment of the floral list in deer forests by at least 66 per cent.

It is a noticeable fact that in farm woodlot country, even if there be a heavy stand of roe deer, the pressure on palatable browse is much lighter, presumably because agricultural plants absorb the load.

Artificial Feeding.—Most deer forests are artificially fed in winter, and many in summer as well.

The winter feeding is done at stations provided with hay-racks, feeding boxes, salt trays, and sometimes root cellars. The hay-racks are usually roofed against snow. Sometimes a separate rack is main-

tained for roes, being fenced with palings so spaced as to exclude the larger deer.

The feeds used at stations include hay, shocks of small grain, potatoes, rutabagas and other root crops, horsechestnuts, and acorns. The last two are gathered in the fall for winter use.

Some winter stations also have adjacent food patches or "game acres" planted to "Topinambur" (Jerusalem artichoke, *Helianthus tuberosa*). This sunflower offers not only a palatable top, but numerous potato-like underground tubers, which are plowed up in fall to make them available to the deer. This plant is also used at pheasant stations. The tubers are not injured by frost. Enough of them remain in the ground to grow successive crops for several years without replanting.

The summer feeding consists of "game acres" planted to oats, rye, or clover. Fences are opened at the appropriate season to give access by game.

Intermediate between artificial and natural feeding is the draining, plowing, liming, and reseeding of natural meadows, to increase the proportion of clovers and raise carrying capacity. Such meadows may be fenced to furnish hay for stations, or left open for summer grazing.

Another semiartificial means of meeting the deer feed problem is to underplant mature pine forest with oak, ash, blackberry, or other browse plants. This has been done to build elch range at the Schorfheide and in East Prussia, but in general such artificial extension of natural game foods is surprisingly rare in Germany.

Damage.—Artificial feeding, by keeping alive deer which would otherwise starve, of course enlarges the discrepancy between game density and natural forage, and thus also enlarges the variety and intensity of game damage to forest vegetation and to adjoining agriculture, which in turn gives rise to a great variety of protective expedients. These, while not always effective, are always expensive and often ingenious.

For example, red deer during the spruce era formed the habit of stripping bark from young spruces of pole size. The stripping is done with the teeth, and is called *Schälschade*. It probably expresses a vitamin or mineral deficiency. To protect spruce from deer, bundles of dead spruce twigs are wired around the trunks at an appropriate height. Thousands of such "bundled" trees can be seen in some forests. It must represent a cost comparable to fire and insect protection.

Newly planted spruces are tarred against browsing. Young larches and Douglas firs are bundled against browsing, and also against horn-rubbing by roes. Planted hardwoods, where unfenced, must always be bundled with dead spruce stems, unpruned so as to form a sort of bristle of stiff dead twigs.

The most universal protective expedient is, of course, the game fence. The mediaeval nobles started the fencing habit by building stone walls, within which game drives could be conveniently conducted. Wire or pole fences now attempt to keep the deer out of a large percentage of all reproduction areas. Fences also often parallel the exterior boundaries of the forest to keep the deer out of the adjoining fields. The deer are thus ground between the upper and nether millstone by fences which keep them out of all feeding areas. A prohibitive pressure is exerted on any hapless forage plant attempting to gain a foothold on the range which remains open to deer.

Density, Kill Ratio.—Some sample deer densities, as now maintained under various degrees of overgrazing, are indicated in Table 2. On a rich range many of these would rate as by no means exces-

sive. But the range is not rich, and cannot become so as long as the deer are there, nor as long as pure-conifer forestry prevails.

The percentage of the deer stand removed yearly is hard to get. Good kill data are common, but good censuses scarce. Accepting the censuses of local forest officers, the kill-ratios for some of the areas in Table 2 are as follows: Area A, 18 per cent; Area C, 18 per cent; Area E, 33 per cent. The kill ratio for the Tharandterwald (not in Table 2) appears to be about 38 per cent.

Motives

It is now time to meet the reader's inevitable question: Why are these conditions allowed to persist?

It should be said, to begin with, that the new official policy calls for fewer and stronger deer. The ultimate extent of the necessary reduction remains, however, undefined. On some forests reductions have already been carried out (see Remarks, Table 2). Probably few Germans are aware of what we in America have learned on scores of millions of acres of National Forest: that a range once down tends to stay down, even after radical cuts in grazing herds.

By and large, it must be said that the prevailing policy is still in some degree a temporizing one. Why?

The easy answer for visiting Americans is to assume that the forest officers (who exercise most of the forest hunting privileges) are unwilling to curtail their private pleasure for the public good. What I think is a much more accurate answer was given me by one German forester, who said simply: "It's a love affair." He was speaking not only of forest officers, but of all Germans. In other words, the Germans would rather put up with damage than forgo their pleasure in having and seeing deer.

It is to me not unthinkable that this little side-light on the German attitude toward the things of the land may touch upon an asset in the national character which outweighs, in the long run, the present liability of the deer problem.

Consequences

The Dauerwald movement hopes to mix hardwoods into the conifer stands as individual trees. The actual effect of the little fenced hardwood plantations will, in pine at least, be clumps and spots of pure hardwood. Intolerant pine can never be reproduced under tolerant beech. In spruce the parity in tolerance removes this difficulty.

Thus deer will make the pine mixtures of 1975 lumpy instead of smooth, and thus somewhat reduce the soil benefits.

Deer and spruce jointly are exterminating as forest plants the raspberry, blackberry, and other palatable berries which are necessary to good Auerwild, Birkwild, and Haselwild range. Thus deer are being maintained at the expense of the forest game birds.

The combination of wood-factory silviculture and deer has been ruinous to many species of songbirds and flowers. Vietinghoff has begun accurate ecological measurements of the effect on songbirds, and has devised techniques for its amelioration. This and other questions pertaining to "Naturschutz" are treated in a separate paper.

Lastly, the damage to the deer stock arising from generations of unnatural food is not to be overlooked. Most German foresters admit a gradual deterioration in antler size and quality. That this is partly due to culling prime males, and can be reversed by culling the defectives and by a more natural sex ratio, has been already explained to Americans by Shepard. That it is also due to nutritional deficiencies, and can be reversed by arti-

ficial diets, is proven by certain prodigious heads recently grown in a small enclosure in Czecho-Slovakia. That it can also be reversed by restoring the natural foods of the mixed forest, stands to reason. A measured instance of heads improved by scientific feeding has been described by Vogt.

Degeneration of deer within fenced game parks has been statistically established by Bieger. He shows that both red and roe deer under fence are from 10 to 18 per cent lighter than animals on adjacent free range. The annual kill per unit area is greater under fence for red deer, but less for roe deer. It seems self-evident that the biological penalties of overgrazing the open range differ in degree, but not in kind, from the overgrazing of fenced game parks.

The following observation made by Prof. Dr. Röhrl is illuminating: In 1895, the nun-moth devastated a large area of spruce forest in Oberpfalz. A thick growth of fireweed, *Epilobium angustifolium*, seeded in on the bare area, and persisted for three years. Fireweed is rare in spruce forests because there are no fires, and cuttings come quickly to grass.

Roe deer were seen to concentrate on this new food, where they unexpectedly developed "capital" antlers, whereas the locality had previously yielded only weak heads. The "capital" heads lasted as long as the fireweed, but after that were no longer seen.

Fireweed (not necessarily following a fire) is probably one of many nonwoody plants now excluded from German forests by too many deer and the wrong kind of forestry.

Table 1

PALATABILITY OF GERMAN DEER BROWSE

Class I. Preferred food (very palatable)	
Oak	Wild apple and pear
Beech	Raspberry
Mountain Ash (*Sorbus*)	Blackberry
Willow	Rose
Maple	Mistletoe
Yew	
Class II. Staple foods (palatable)	
Silver fir	Heather (*Calluna*)
Larch	Broom (*Sarothamnus scoparius*)
Aspen	
Black locust (*Robinia*)	Elder
Ash	
Class III. Emergency foods (eaten only when hungry)	
Spruce	Juniper
Pine	Blueberry
Linden	
Class IV. "Stuffing" (seldom eaten, or only when starving)	
Birch	Hazel (catkins palatable)
Hornbeam (*Carpinus*)	
Wild cherry (*Prunus serotina*)	Haw (*Crataegus*)
	Buckthorn (*Rhamnus*)

American Applications

The "wood factory" concept fell on friendly soil when transplanted to prewar America. It would be foolish, of course, to infer that it contains no truth. It would be equally foolish to overlook the degree to which it has been amended and superseded in its place of origin by new and broader concepts of forest land use. The Germans now realize that increment bought at the expense of soil health, landscape beauty, and wildlife is poor economics as well as poor public policy.

What specific amendments of American practice are indicated by the German experience?

First, I would say that a generous proportion of each forest must be devoted entirely to floral and faunal conservation. The National Resources Board has suggested 3 per cent. This seems to me much too small. After seeing German silviculture in practice, I have the impression we would do well to develop an intensive silviculture on the better half of our forest soils, and leave the other half primarily to other uses. In other words, pull our working plans down out of the cliffs and rocks, and let those places grow game and scenery.

Secondly, I would point out that the German impasse is probably exaggerated by the fact that deer predators are extinct. Where hunting is the only available control of deer population, every error in regulating the size or nature of the kill carries an immediate penalty. Where predators are present they may "cushion" the mistakes of the game managers, i.e., there may be an automatic adjustment between predation and carrying capacity, such as that found by Errington in quail. He finds that when quail exceed the carrying capacity of their range, the predation rate goes up, thus mowing off the excess, whereas when they fall below, the rate goes down, thus conserving the breeding stock. There are few American deer ranges where the total removal of deer predators seems justifiable or necessary.

A third and obvious lesson is a deep respect for natural mixtures, and deep suspicion of large pure blocks of any species, especially species not indigenous to the locality. The extension of conifers now being undertaken through the C.C.C. seems sound if not carried too far. In the Lake states, for example, such plantings will provide winter cover in stands artificially converted to pure hardwood by fire. But to extend such plantings over large solid blocks would be to reproduce the German forest, and the German problem.

I view with less equanimity the "timber-stand improvement" cuttings, both of weed trees and dead material. This work has expanded too fast, and men to execute it judiciously are not available.

Fourthly, I plead for some hard thinking on the problem of dual jurisdictions over game. If the German foresters, with sole jurisdiction, can get themselves into such a fix, what can we expect when authority and responsibility are divided? I personally doubt whether a satisfactory answer to this question has as yet been proposed.

Lastly and in general, I plead for a generous policy in building carrying capacity, and a stingy one in building up stock. Lucky is he who has a comfortable margin of safety between the two.

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Table 2

SAMPLE BIG GAME DENSITIES IN GERMANY

Area	State	Acres	Red deer	Fallow deer	Roe deer	Boar	Acres per Total	Acres per head	Remarks
A	Saxony	7,300	100	18	600		718	10	Severely overbrowsed
B	Bavaria Bohemia	5,000			200		200	25	Unfenced, not seriously browsed
C	Baden	6,200	W[1]		400	W[1]	400	15	Unfenced, not severely browsed
D	Württemberg	5,000	W[1]		500	W[1]	500	10	Unfenced
E	Württemberg	1,250			120		120	10	Unfenced, been severely reduced
F	Saxony	4,500	80		60		140	32	Unfenced; deer recently reduced 80 per cent
G	Silesia	62,000	550	200	1,000	50	1,800	34	Fenced, heavily fed, poor soil. Badly overbrowsed.
H	Anhalt	2,200	20	80	150	50	300	7	Unfenced, probably use fields. Overbrowsed
I	Brandenburg	2,400	60	30	300	70	460	5	Fenced. Deer now being reduced
Total		95,850					4,638	21	

[1]"W" indicates "Wechselwild," i.e., occurrence of casual or drifting individuals.

[1]Covers both April and May articles; authors' names in text unaccompanied by reference number.

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FOREST WILDLIFE CENSUS METHODS APPLICABLE TO NEW ENGLAND CONDITIONS[1]

IT would be difficult to find any sizeable, successful manufacturing concern conducting its business without knowing what raw materials it has in stock, what production can be maintained, and what profits can be taken out of the enterprise. But the production of wildlife, a business aggregating several million dollars in New England each year, is run in most places with only a guess as to this basic information, and yet with the hope of good results. Just as the timber estimate is the basis for intelligent timber management plans, repeated censuses are necessary in order to manage effectively any area for the production of wildlife. To quote Aldo Leopold on the subject of censuses: "Measuring the response of game populations to changes—deliberate or accidental—in their environment is the big purpose. Continuous census is the yardstick of success or failure in conservation." (3). In addition to giving the initial breeding stock on an area, repeated censuses show the increase or decrease in population; the allowable kill can be calculated from them; and, if carried out at different seasons, they are a check on movements, seasonal mortality, and use of different types of vegetation.

There are three general types of census methods, and many variations. The first of these is that of direct enumeration, by totals or samples. This is the most accurate method, and gives real quantitative results. A second method is based on estimates of total populations from banding or otherwise marking the animals, releasing them, and getting the percentage of the total kill represented by marked individuals. This method is one which is usable on migratory species, and is simple in operation. However, it is dependent upon the accuracy of the returns from hunters, and will be much more useful when all states get accurate kill records each year. The third general type is that of indirect observation through indices of one kind or another, such as the number of animals taken by a given number of traps set one night in different sections, birds flushed per hour by a dog, etc. This kind of census is never anything but a relative figure in either time or place, but is useful as such, and can sometimes be carried on with other work (2).

For censusing some of our New England species there are methods used enough to be of proven worth, but with other species we don't know even how to attack the problem. In the latter cases intensive study of the animal may show some peculiarity which will allow it to be censused.

Deer drives over definite areas by a line of drivers working toward a line of observers have been used generally over the country, especially since C.C.C. crews have been available to furnish the large numbers of men needed. This method is necessarily limited to sample areas, which makes it very necessary that someone well qualified should pick samples representative of the region. The areas must be of known size and definitely bounded by such features as roads, water, fire or power lines, etc. The general plan of operation is for a straight line of drivers to start at an appointed time on one boundary of the tract, moving across and forcing the deer either back through the line

[1]Report of New England Section Sub-committee on Fish and Game Management. The Committee states that Dr. R. E. Trippensee of Massachusetts State College was very helpful in revising the manuscript.

or out between observers stationed on all sides of the area except the one where the driving line started. The drivers must be close enough to see each other in the densest cover encountered. They should not be over two chains apart, and preferably not more than one chain. The foreman should have, in advance, a good working knowledge of the topography and timber types in order to determine the interval between drivers. The line must be kept straight to avoid straggling and breaks between drivers; and to accomplish this, foremen should be either stationed at intervals in the line, keeping direction by compass and watching the drivers, or else moving back and forth along the line to keep it straight. Another method of accomplishing this is to re-form the drivers along painted lines parallel to the starting line. The observers must be absolutely quiet; but the more noisy the drivers are, the better. The observers watch on one previously designated side, only as far as the next man, and tally deer crossing on this side. The drivers tally all animals crossing back through the line; and since there is no cause for quietness, it is best to check each animal with the driver on the other side in order to avoid duplications in the tally and to make sure none is missed. The drive should be carried out when hardwood leaves are off. The fall period just before the hunting season has given best results. The method is limited in its accuracy by the keenness of the drivers and observers, so they should be picked carefully. A type map of the area driven is very useful in evaluating results. This method is the standard in Region 9 of the Forest Service, and has proven satisfactory in use wherever properly carried out (7).

In regions where deer yard, they can be censused either by counting the tracks leading to the yard through the first deep snow or, in some cases, by observation of the animals in the yards after they are all there (3).

A reasonably accurate census can be made in regions where there are no yards by tracking on new snow. Parallel lines are run by compass covering the area at intervals of 1,000 feet or less, according to snow depth and density of cover. When tracks are found, they are followed until the direction of travel and the number of animals are certain. This latter point is important because as many as four ainmals may walk for some distance in what appears to be one set of tracks. Allowance must, of course, be made for recrossings of the same set of tracks, and a type map on which they can be plotted is a great help. The method is useful with low densities of population, but with heavy stockings, unraveling the tracks is hopeless.

Patrol inventories, counting deer seen per hour from automobiles driven over back roads, have been tried but given up as unsatisfactory, due to the large number of complications affecting the results. Some of these are traffic ahead of the patrol car, time of day, visibility, differences in quietness of patrol cars, season, local migrations of deer, etc. (7).

In the report on Wild Animal Damage to New England Forests (1), a Committee of this Section in 1931 outlined a method for getting rough deer population figures for a state from kill records over a period of years.

The state of Maine uses its deputy wardens to make up each spring an estimate of the deer, moose, and beaver for the towns in their districts. This information is obtained incidental to law enforcement work; and although an individual warden may be high or low on the estimate for his district, the figures for the entire state are of considerable value. This method is, of course, most useful in regions where deer and moose yard.

With the ruffed grouse, the method de-

veloped by R. T. King of the University of Minnesota, and adopted by the Michigan Conservation Department and by the Forest Service for Region 9, is giving good results following considerable use. The area to be censused is laid off into 40-acre blocks by compass lines marked so they can be followed in later observations. All these 40 lines and half of the boundaries are followed out by a trained game man, each bird flushed being recorded by a serial number, with flushing distance from the observer and the location plotted on a field map. Where the strips intersect and a bird is flushed near the same location a second time, it is recorded only once. The red and gray color phases and the size of the birds help in determining the number of those flushed a second time. No censusing is done during blizzards, rain, high winds, or when the brush is very wet. In case an area of four sections (2,560 acres) cannot be completed without breaks of two days or more, the census is started over again. This area can be covered in five man-days under Lake states conditions (7). The estimate of the grouse population is best computed by first making up a table of the cover types, by age classes and densities of stocking, for the sample area. Then the area of strip covered (twice the average flushing distance times length): the total area in a particular type, density, and age class = the number of birds flushed: the total population of this same unit; or stated differently,

$$\frac{\text{total area} \times \text{birds flushed}}{\text{area of strip covered}} = \text{total population.}$$

Birds estimated for the different densities of stocking and age classes are added to get the type totals, and these are added into a grand total for the census area.[2]

A method used during the present year on about 1,000 acres at Petersham was to make a total census, using a bird dog and recording on a type map birds flushed and roosts or tracks seen. Working in this way, it was soon found that under early winter conditions, only the types containing conifers had any appreciable numbers of birds in them, and the bulk of the time was accordingly spent on these types. The first census of the area was made at the rate of about 200 acres per eight-hour man-day. This method is, of course, useful only with observers who know grouse, and a good dog that can be well controlled is practically a necessity.

R. T. King has developed a method of censusing based on the habit of the grouse hen of trying to lead an intruder away from her brood of chicks. Using this means of easily locating the birds, either sample strips or plots are covered, under Minnesota conditions, during the week when pink ladyslippers begin blooming, when the large-toothed aspen leaves are half out, and black ash buds are just bursting. The width of strip is taken as twice the average flushing distance. The number of hens observed is used as representing the female part of the plot population, and the total obtained for the whole area by using the best estimate available for the sex ratio. The number of males can be checked by the number of nonfeigning birds flying a good distance when flushed. The method is applicable for only a week or two, but has the advantage of giving a good idea of nesting success for the year. Of course, unmated females or those unsuccessful in hatching tend to upset the accuracy of the method, and just before and during the low points of the cycle of abundance the population is apt to be excessively male (3).

The number of drumming males can be used as a rough index of abundance

[2]Wakeman, M. C., in a letter written to the sub-committee chairman and describing the use of the method in Michigan.

if, again, the sex ratio is known. This method can be used from the first real spring weather until June 1, and the drumming is most regular at shorter intervals near sunrise and sunset or just after a storm. The ventriloqual effect of the drumming is least at the end of the performance. This method is especially useful with sparse populations, or in areas where cover is limited to scattering woodlots (6).

Hunting records such as are occasionally available for a locality, giving the birds flushed by a given hunter per hour, are valuable comparisons between years. They have little value as far as showing average conditions, because a good hunter avoids poor covers.

Censusing the cottontail rabbit or snowshoe hare by any reliable method is still something for the future. The abundance of tracks is, of course, a good indication of the number of rabbits, and with low population densities may make a fair census; but where the animals are abundant, it is difficult to make even an intelligent guess as to numbers. Kill records such as those maintained by Pirnie in Michigan are very valuable where they can be accurately obtained for a given area (5).

Woodcock breeding in an area may be roughly censused by listening for the nuptial flights of the male at favorable nesting locations, such as near wet hardwood runs, alder swamps, etc. These flights occur at dusk, and at Petersham are most common during late April and early May.

Little has been done to determine methods of censusing furbearing mammals. Valuable local information can be obtained from professional trappers who know the animals in their region well enough to make a good estimate of the numbers.

R. P. Holdsworth and J. P. Miller, working on the Mount Toby Forest of Massachusetts State College, developed a very valuable method of getting population and seasonal movement data while doing other work on the forest. Any wildlife or signs of it observed were recorded on type maps, one for each of the four seasons. Observations were made continuously by the Forest Superintendent, and by any others who happened to be working on the tract. These notes over a period of several years have given some very good information on populations and the seasonal use of different cover types. The method is one which has considerable promise on any managed forest where wildlife is an important interest.

J. P. Miller, who has been carrying on wildlife research work at Mill Village, N. H., for the Biological Survey, has modified the method used at Mount Toby, mainly through the use of a system of north-south and east-west lines gridironing the census area at intervals of four hundred feet. The censusing is done at as regular intervals as possible by specially trained C.C.C. enrollees. They cover the tract by irregular lines of travel until they find the ruffed grouse, which are the main interest from the management standpoint. They record on a mimeographed form all the signs noted for all species. These notes are referenced to the grid lines and are transcribed in the office to the seasonal type maps. Repeated observations have shown how many grouse are in a particular area, and have been the means of tracing not only the total populations through the year but also the mortality and, in many cases, its causes.

Wherever banding or marking can be done with any species being managed, the chance should never be missed, because of the many possibilities for information which the returns may show. Where a chance is offered for marking enough of any one species to make a good sample of a local population, the banding

returns compared to the total kill indicate very well the total population as worked out by Lincoln for ducks. In this calculation, the number banded: total population = the number of banded kills: the total kill (4).

Our census methods of today are sadly lacking for many of our important species, and we can only look hopefully to the increasing activities in wildlife research for the knowledge of habits which will allow us to get the fundamental information on populations with which to make a beginning in sound management.

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FOREST MANAGEMENT AND DEER REQUIREMENTS ON THE ALLEGHENY NATIONAL FOREST

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IN the February, 1936, JOURNAL OF FORESTRY, under caption "The Correlation of Forestry and Wildlife Management," Gabrielson makes a plea to foresters to arrange their programs of forest management with a view to favoring as great a supply of game as is consistent with good forest practice. Specifically, he suggests a rotation of cutting so that on a given unit there would always be some proportion of newly or recently cut-over area to create a continuity, throughout the cutting cycle, of existing margins and young growth favorable to the supply of game food. The author also cites, in reference to the deer herd on the Allegheny National Forest, an acute problem because the forest is growing into a more advanced and unfavorable age class.

For the present purpose, the thoughts here expressed are confined particularly to conditions in the beech-birch-maple type, which predominates in northwestern Pennsylvania, the location of the Allegheny National Forest, and primarily to the deer problem. It is not the purpose here to offer objections, from a forest viewpoint, to a rotational plan of management for the purpose of furnishing a continued supply of game food, although heavy browsing by deer and gnawing by rabbits in young reproduction can be a very serious threat to the quality of the future stand of timber; rather it is to point out convictions, based on observation, that such a plan would not produce a maximum of food supply where and when it is most needed.

Possibly no serious objections will be taken to the statement that the maximum game-carrying capacity of a given range is limited by the *available* food supply during the late winter season, and that the amount of available food varies with the severity of the winter; at least my thoughts are based on this premise being generally correct. If it is so, then the effort should be made to provide for the greatest possible *available* food supply under the severest conditions. Before the effort can be planned properly, intimate knowledge of general deer actions, as well as their feeding habits, must be had.

The remarks herein expressed are based on familiarity with conditions in the region for over twenty years (since the time a deer was a "rare bird"), and more important, on observations very frequently made throughout the winter months, the season the man on forest research usually spends on office work. Throughout the fall and until the end of the hunting season (December 15 in Pennsylvania), deer are widely scattered and move freely through all varieties of cover conditions on wild land and adjacent clearings. It is my observation that their principal food supply is then from herbaceous and viny plants, for which they paw on the forest floor; that this food source seems sufficient for a heavy population even in a wide territory of even-aged stand of second-growth hardwood, where browse from tree growth is at a minimum; and that they continue to prefer this food source until deep or crusty snow forces them to browse from woody plants.

The general topography of the Allegheny headwaters is one of more or less wide plateaus cut by rather steep slopes converging to narrow valleys. As the

snows deepen, the deer drift to the lower slopes of southern and western exposure, and to the stream bottoms. On these slopes the sun has the greatest effect toward reducing the depth of snow and prolonging the availability of the ground source of food. Under the severest winter conditions it is here that deer generally yard up. When deep and crusty snow prevails, it is along these bottoms and lower southerly and westerly slopes that one finds a labyrinth of well beaten game trails, whereas if one strikes across the upper slopes and plateaus of forested land, he meets an expanse of snow rarely broken by a deer track, old or new. In the bottoms and lower slopes mentioned, the source of woody browse is generally most abundantly available. On the slopes of such exposure the forest stand is invariably more open, with a broken canopy of the hardwoods, permitting a greater abundance of browse that is within reach, both of hardwood and hemlock, while on the plateaus and north slopes a much closer and higher canopy of forest usually exists. In the bottoms an even greater tendency to a broken forest canopy generally holds good; young hemlocks are more abundant, and the creek banks and bars are often covered with willow; likewise, there is often an abundance of hardwood browse.

Just here, let me insert an observation of a condition which I believe is largely instrumental in maintaining the uneven-aged forest growth in the bottoms. Rabbits and hares, as well as deer, like the bottoms for their winter feeding grounds. The cycle of low to high population of rabbits covers a period of several years. When they are abundant, and the snows are deep, it is clearly noticed that they congregate in the bottoms—then we see a severe destruction of the smaller hardwoods by their bark gnawing and girdling activities. Thus this concerted action in localized sections makes frequent openings in the stand, providing opportunity for seedling and sprout growth to start anew, to furnish future food supply to rabbits and deer alike.

Undoubtedly here the thought has arisen in the mind of the advocate of the rotation plan of cutting: this is the very purpose of the plan—to supply young growth for browse. But there are several reasons why such a plan does not seem the best answer. One is that deer when "yarded up" will not readily leave their yards under severe traveling conditions. As long as the older and larger deer can reach browse, there they stay; and the young do not leave them, to their own misfortune, when the browse gets beyond their reach, or when they are forced to too unbalanced a diet. This is borne out by the fact that deer found to have died from malnutrition or starvation are usually the smaller animals, and are usually found close to the streams.

Under conditions as they now exist in mid-February, 1936, the winter has been hard and continuous, snow piling up since late November and crusting so that when a deer leaves the broken trail on the jump he comes up short with bleeding legs; so the deer sticks close to the yard area. At present he seems to feed principally on last year's growth of hemlock, and on willow, and only to a minor extent on the tips of the hardwoods—birch, maple, and beech. I know of deer whose normal range covers a recently clean-cut area on a high plateau on which there is an abundance of low hardwood reproduction, but they are sticking to their trails in the bottoms and lower slopes and make no effort to cross the intervening quarter-mile of unbroken snow crust to get to the slashing.

Further, it is noted that during the winter season the human interference with deer is at a minimum, so that they are rarely forced to leave their yards through fear. In fact, under present conditions,

a deer will take but a few jumps through unbroken crust when startled—as soon as he gets to a runway he will travel, but he sticks to the broken trail. If the foregoing be generally true, it follows that a large percentage of forested areas, even if in young reproduction, is not *available* for food under such conditions.

Another reason why rotation by clean cutting, at least, does not seem the best answer: in the forest type under consideration, on the better growing sites the hardwood reproduces on a clean cutting so densely that the hemlock reproduction is excluded even when seed source is present —and hemlock is of importance for winter feed.

Perhaps the most important reason for seeking a better answer in the region is this: supposing a timber-maturing cycle of eighty years, as has been suggested, is considered. Over a large part of the region in which the Allegheny Forest is located, the virgin stands were stripped off during the period from 1890 to 1910, resulting in a more or less even-aged forest now twenty-five to forty-five years of age. What will happen to the deer during the next forty years or so, while we wait for the timber to mature so that the cutting cycle can be begun?

So why not learn from the examples we see in nature, and accept facts as they exist? Under the limiting factors for available food when winter conditions are severe, the deer do stick close to the bottoms and lower southern and western slopes. The actions of the rabbits during the winter have shown how food supply has been maintained in the bottoms. Therefore, it would seem advisable for the present, at least, if we wish to maintain the maximum of deer feed under the limiting conditions of severe winter, to concentrate efforts upon the location of bottoms and lower slopes.

From the standpoint of woods operation, the bottoms are invariably used as the main arteries for transportation. This being so, frequent selective cuttings, or thinning from the top, on such locations may be the present answer. In the region, a strong market exists for chemical wood and pulpwood, so that such cutting and thinning is feasible from an economic standpoint at an early stage in the forest growth. Why not classify such locations so that in their forest management, game food may be given the position of prime importance? With such localization of effort, a greater proportion of the favorable margins would result for the acreage treated, and the margins would be more or less permanent. Further, by following the stream bottoms, they would form a network throughout an area easily available from any portion thereof.

If the foregoing observations and suggestions have any value to the game conservationist, it is then evident that a need does exist for closer cooperation between the forces of wildlife and forest management.

A BUD AND TWIG KEY TO THE SOUTHEASTERN ARBORESCENT OAKS

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THIS key is presented with the hope that it may be of use in the winter identification of the oaks growing in the southeastern part of the United States. The region covered by the key is that occupied by Virginia, North Carolina, South Carolina, Georgia, and northern Florida. So far as is known, no key is available for the oaks of this region which deals only with bud and twig characters, and at the same time includes all the species of tree size.

All the species discussed in "Trees of the Southeastern States" by Coker and Totten (1) are included with the exception of two, *Quercus austrina* Small and *Quercus borealis* Michx. f. The latter enters the area only in the high mountains of North Carolina, where it grows above 4,000 feet. The nomenclature follows Sudworth (6) and Sargent (5).

The keys to the oaks in "Keys to Woody Plants" by W. C. Muenscher (4) and in "Twig Key to the Deciduous Woody Plants of Eastern North America" by W. M. Harlow (3) are satisfactory for the northern oaks, but they do not include all those of the Southeast. The latter came to the attention of the writer after the completion of this work. The recent key by Dyal (2) is based almost entirely on foliage characters and is, therefore, of little practical use in winter identification.

The writer wishes to acknowledge suggestions taken from "Winter Botany" by William Trelease (7) and to thank Dr. C. F. Korstian and Dr. H. L. Blomquist of Duke University for their interest and helpful suggestions in the preparation of this paper.

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1. Twigs bearing evergreen leaves ..... 2.
1. Twigs without evergreen leaves ..... 5.
2. Twigs scurfy pubescent ..... 3.
2. Twigs glabrous ..... 4.
3. Undersurfaces of leaves thickly pubescent; buds rounded, under 2 mm. in length, reddish ..... *Q. virginiana.*
3. Undersurfaces of leaves glabrous; buds pointed, 2.5 to 4 mm. in length, brownish ..... *Q. chapmanii.*
4. Leaves rarely over 1½ inches long; buds dull brown, angled, pubescent at tip ..... *Q. myrtifolia.*
4. Leaves usually 2 to 3 inches long; buds bright red brown, not angled, glabrous ..... *Q. laurifolia.*
5. Terminal buds rounded, as wide as long ..... 6.
5. Terminal buds pointed or slightly rounded, longer than wide ..... 10.
6. Twigs pubescent ..... 7.
6. Twigs glabrous ..... 8.
7. Twigs sparingly pubescent; bud scales brown with gray ciliate margins ..... *Q. durandii.*
7. Twigs densely light pubescent; bud scales light brown, not margined ..... *Q. stellata.*
8. Buds reddish, shiny, 3 mm. or more in length ..... *Q. alba*
8. Buds grayish or light brown, dull, 1 to 1.5 mm. in length ..... 9.
9. Bark of young branches peeling ..... *Q. bicolor.*
9. Bark of young branches not peeling ..... *Q. lyrata.*
10. Buds glabrous or pubescent only at tip ..... 11.
10. Buds pubescent all over ..... 21.
11. Buds small, under 4 mm. long ..... 12.
11. Buds larger, 4.5 mm. long and over ..... 17.
12. Twigs grayish pubescent; buds grayish pubescent near tips or nearly glabrous ..... *Q. ilicifolia.*
12. Twigs glabrous; buds glabrous or pubescent only at tips ..... 13.
13. Buds long and narrow, 3 to 4 times as long as broad, not pubescent at tips ..... *Q. phellos.*
13. Buds shorter and broader, twice as long as broad, usually pubescent at tips ..... 14.
14. Bud scales lacerate; twig reddish brown ..... 15.
14. Bud scales ciliate; twig dull yellow or gray brown ..... 16.
15. Bud and twig shining red; twig slender ..... *Q. georgiana.*
15. Bud dull grayish chestnut brown; twig stout ..... *Q. palustris.*
16. Twig glaucous gray brown ..... *Q. imbricaria.*
16. Twig dull yellow brown ..... *Q. stellata* var. *margaretta.*
17. Buds obtuse; scales definitely gray margined; bud scarcely twice as long as broad ..... *Q. muehlenbergii.*
17. Buds acute to acuminate; bud scales not margined; bud 2½ to 3 times as long as broad ..... 18.
18. Buds dull straw colored ..... *Q. shumardii.*
18. Buds red brown ..... 19.
19. Buds ovoid, constricted at base; twigs not bitter ..... 20.
19. Buds conical, not constricted at base; twigs bitter ..... *Q. montana.*
20. Buds glabrous ..... *Q. borealis* var. *maxima.*
20. Buds pubescent above middle with buff or grayish hairs, sometimes becoming glabrescent ..... *Q. coccinia.*
21. Terminal buds 6 mm. long or longer ..... 22.
21. Terminal buds 5 mm. long or shorter ..... 26.
22. Twigs puberulent or tomentulose ..... 23.
22. Twigs glabrous ..... 24.
23. Twigs stout, puberulent becoming glabrous; buds large (8 x 3 mm.), covered with rusty pubescence ..... *Q. marilandica.*
23. Twigs slender, densely tomentulose; buds narrow (6 or 7 x 2 mm.), red brown, pubescence scanty ..... *Q. cinerea.*
24. Buds fusiform, bright brown; twigs sometimes scantily puberulent ..... *Q. catesbaei.*
24. Buds angled, dark red brown or grayish ..... 25.
25. Buds densely pubescent with buff or grayish hairs; twigs usually reddish brown ..... *Q. velutina.*
25. Buds scantily pubescent or silky; twigs usually olive brown ..... *Q. prinus.*
26. Buds dull gray brown; first year twigs glabrous ..... *Q. nigra.*
26. Buds bright red brown; first year twigs puberulent ..... 27.
27. Buds strongly angled ..... *Q. rubra* var. *pagodaefolia.*
27. Buds terete or nearly so ..... *Q. rubra.*

AN INTERNAL-FAN KILN FOR DRYING SEED CONES

By RAYMOND C. RIETZ

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Although the drying of seed cones with artificial heat to quicken the opening of the cones has been a practice in North America and in Europe for some time, the results obtained point to a need for improved apparatus. The purpose of this paper is to describe a cone kiln that will do the job in less time than most existing seed cone drying methods and at the same time will yield more viable seeds per bushel of cones at a lower cost per pound of seed produced.

BEFORE describing the new cone kiln it is perhaps best to review briefly previous work on the drying of seed cones.

Previous Methods of Seed Extraction

Toumey (5) has carefully studied the air drying, solar drying, and kiln drying of seed cones. He describes the outstanding kiln types used in the United States, Canada, Germany, and Sweden. The type of dry kiln that has met with greatest favor in the United States is the so-called tray type, designed as a simple natural circulation kiln. This kiln has an oven or compartment in which the seed cones are spread on wire mesh trays or perforated drawers of various sizes and spacings. The seed cones are usually heated in the trays by convection of heat from a hot-air furnace commonly located beneath the oven or compartment. With this type of kiln, the seeds are extracted by shaking after the cones have been dried and opened. One of the objections to the natural circulation tray-type kiln is the lack of uniform drying of the cones due to the low rate of circulation and the long upward air travel through the trays of cones.

The other outstanding kiln types employed for drying seed cones, particularly in Europe, are the drum and tunnel types. In these kilns the drying and shaking of the seed cones are combined in one process, the drum or cylinders being rotated in a heated room. The drum-type kilns are designed to stir the cones in order that they may be more uniformly dried, and at the same time utilize the stirring movement to shake out the seeds.

The Annaburg plant described by Recknagel (3) is a German installation of the drum-type kiln. This plant employs natural circulation in that the heat from the furnace reaches the seed cones to be dried in the revolving drums by convection only. Another cone kiln of this general type has been installed at Angus, Ontario, by the Ontario Forestry Branch, and is described by Richardson (4). Whereas the Annaburg plant is solely a natural circulation kiln, the Ontario plant utilizes two 12-inch fans to force the movement of air in the room in which the drums are located. Both of these drum-type installations are heated with hot air, the Annaburg plant heating the air with an open fire in the kiln room and the Ontario plant with a hot-air furnace.

The tray and the drum types of dry kilns are generally termed "compartment kilns" and are "batch" dryers. A "continuous" dryer is one in which a continuous flow of material to be dried is carried through the kiln. A cone kiln used in Sweden and described by Baldwin (1) is of this continuous type. It also combines the drying and shaking of the seed cones, as does the drum dryer, but the heated air is carried to the seed cones by forced circulation, utilizing a blower. This latter kiln can be considered as a typical

tunnel dryer in that the cones being dried gradually descend from the top to the bottom of a vertical cylindrical kiln.

Recknagel (3) indicates that the natural circulation tray-type cone kiln has proved unsatisfactory in Germany because the unequal temperatures throughout the kiln result in more rapid drying in certain trays than in others, thus necessitating changing and sorting of trays, which requires extra hand labor. The Annaburg cone kiln tends to overcome some of the objections to the older type of natural circulation tray-type kilns, but still lacks adequate temperature control. Moreover, if the cones are agitated sufficiently in the drum to give good uniformity of drying they are badly broken, and the cost of cleaning the seeds is thereby increased.

In order to decrease the time required to open the cones in the natural circulation tray-type kilns, the temperatures are often increased to the point where the viability of the seeds is endangered. The fire hazard in these installations also increases with the use of higher temperatures, and often the nurseryman has found his extractory in flames. On the other hand, the use of higher temperatures increases the rate of natural circulation, which results in more uniform drying.

The many years' experience of the Forest Products Laboratory in the kiln drying of lumber has shown that both decreased drying time and increased rate of circulation can be obtained with minimum fire hazard by means of mechanically operated fans. It was therefore suggested that the natural circulation tray-type kiln be modified to a forced-draft type kiln by installing a simple disk fan. This was done in the extractory at the Cass Lake Nursery, Cass Lake, Minn., and with other minor modifications Jack pine seed cones that previously required 12 to 14 hours to open were opened in 5 to 6 hours, and Norway pine seed cones that formerly required 8 hours to open were ready in from 4 to 5 hours. The temperature at which these increased efficiencies were obtained was less than that formerly used to dry these species of seed cones.

As forced-draft circulation indicated marked drying efficiencies, temperature and relative humidity control with the use of steam rather than with the use of a hot-air furnace were suggested as further necessary modifications where increased extraction programs were involved. So far as the author is aware, the first forced-draft, steam-heated, controlled seed-cone kiln used in the United States was designed and installed by the Southern Region of the Forest Service. It was built and installed in the fall of 1934 at the Stuart Nursery, on the Kisatchie National Forest, near Alexandria, La. This kiln replaced a natural circulation tray-type kiln that, in order to supply the longleaf pine seeds needed for an expanded nursery program, had been pushed to the point where the whole extractory building was burned down.

The rebuilt extractory is equipped with a tray-type, batch-operated compartment kiln, using steam for heating and humidification and a nozzle system for recirculating the air. The kiln is equipped with an external blower for building up air pressure at the nozzles. In the older natural-circulation cone kiln it required from 45 to 66 hours to open the longleaf pine cones, and a yield of 0.76 pound of seed was obtained per bushel. With the new forced-draft kiln the drying time has been reduced to from 8 to 12 hours, and the yield has increased to 1.20 pounds per bushel of cones. The increased production of this new kiln and the lowered drying costs compared with the old type of equipment are reported to be sufficient to pay for the installation of the new extractory in two extraction seasons.

In drying a material so susceptible to temperature as is tree seed, forced-draft

drying equipment that is controllable as to temperature and relative humidity seems necessary, especially where a volume of 5,000 or more bushels of cones are to be dried and extracted each year. The costs of collection or purchase of seed cones and the invested transportation charges by the time these cones reach the extractory are usually very high, and therefore few agencies can afford to kiln-dry seed cones under conditions conducive to greatly reduced viability. This implies high-grade drying equipment manufactured and installed by reputable engineers and companies qualified to design and install such equipment.

Forest Products Laboratory Internal-Fan Kiln

The cone kiln designed at the Forest Products Laboratory and described here is of the forced-draft tray type. It is adaptable to the drying of small or large cones at whatever drying conditions the particular species of cones being dried requires. The kiln provides for the control of the temperature and the relative humidity of the drying atmosphere, and permits large volumes of air to be circulated at uniform velocities throughout the seed cones in order that viable seeds suitable for immediate planting or for storage can be obtained with low extraction costs.

The design is based on the principle that, where uniform and fast drying is desired, it is more economical to move mechanically the air carrying the heat for evaporation than to attempt to move the material to be dried. With a forced-draft design a short and unrestricted air travel can be had by directing the flow of air horizontally across the trays rather than vertically, thereby obtaining uniform drying of the cones.

The schematic sketches of Figures 1 and 2 indicate the general layout of the kiln. It is an overhead, short transverse-shaft, internal-fan kiln in which steam is used for heating and humidification. The kiln walls and ceiling, in the form of panels, are attached to a steel frame. This frame also supports the overhead fan equipment and heating coils. Two 24-inch disk fans are used, operating at 550 r.p.m. and driven through "V" belts by two ¼ hp. reversible electric motors. The heating coils are located to give efficient heat transfer as well as to break up any velocity heads produced by the fans. The heating coils are subdivided in order that the radiation can be varied to suit the heating demands, and thus provide better temperature control.

The temperature and relative humidity of the kiln are controlled with either an electric or an air-operated recorder-controller. The same instrument automatically controls the amount of air vented by the vent blower when dehumidification is required. This system conserves heat in that only the air necessary to remove the moisture evaporated from the cones is vented. Humidification is provided in order that air-dried casehardened cones can be treated, to facilitate their opening.

The wall and ceiling panels can be made of almost any material. The material should preferably be moisture-proof and fireproof and should possess a fair amount of insulation. With the fan and heating coils located overhead the kiln is easily cleaned, thus reducing the hazard of dust explosion.

The cone kiln can be located on the ground floor or on the second floor of an extractory building, depending on how the cone trays are loaded and how the extractory building is arranged. If steam is not available, it is necessary to provide a small boiler capable of generating low-pressure steam. An ordinary house heating boiler is sufficiently large.

If electrical power is not available, either a small gas-engine generator can be

installed or the fans can be operated directly by a gas engine, the same engine operating a small compressor supplying air for an air-operated recorder-controller.

The cones to be dried are spread on wire mesh trays that are nested on top of one another and all piled on a skid that is moved in and out of the kiln with a lift truck. The spacings between the trays can be varied to suit the size of the cones, 2-, 3-, and 4-inch spacing lugs being provided in the cone tray design. The cone trays are 3 by 4 feet in size, and the kilns long enough so that two skid loads can be put in the kiln. Capacity of the kiln is about 33 to 35 bushels of seed cones.

A single row of skid loads of trays in a kiln, as illustrated, is the preferred arrangement. However, it would be quite possible to develop a good double-row design.

Tray sizes may be determined by local conditions; in general, trays larger than 3 by 4 feet are likely to be difficult to handle. The variable-spacing feature can be omitted when cones of one size only are to be extracted.

It should be pointed out that this particular design is presented simply as one of a number of possible effective arrangements. The one most important requirement is that the kiln, of whatever design, be capable of maintaining the proper temperature and humidity conditions throughout its entire volume and be provided with ample circulation.

The design here presented is not limited as to length; in fact it can be easily shortened to accommodate a single skid-load of trays, or extended to hold as

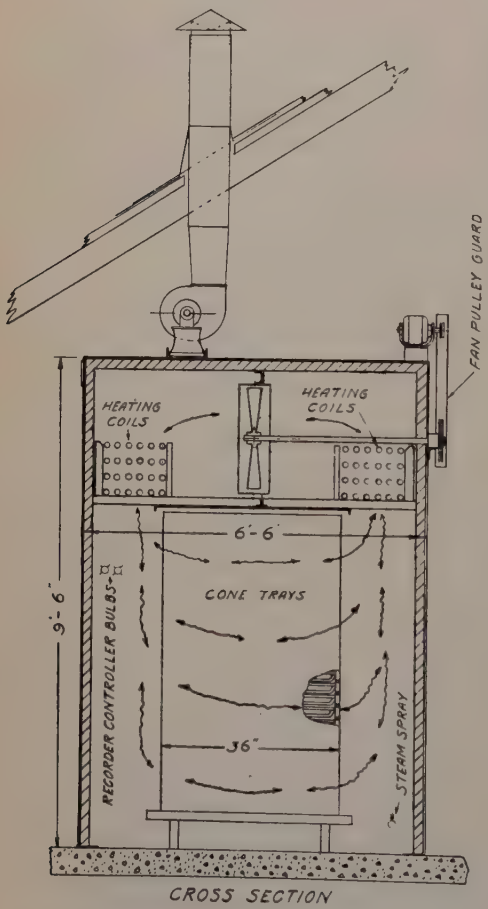

Fig. 1.—Cross-sectional view of Forest Products Laboratory internal-fan cone kiln.

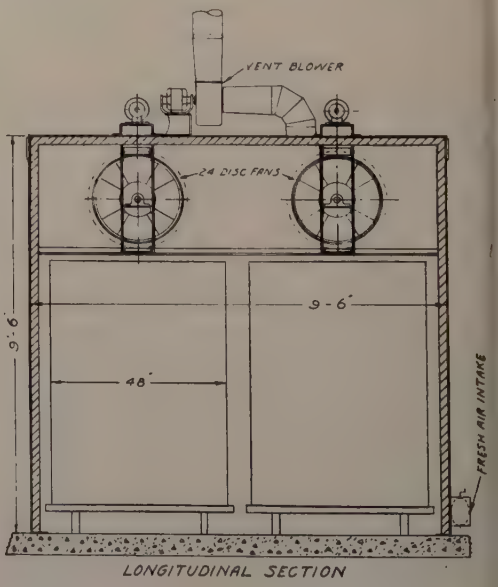

Fig. 2.—Longitudinal view of Forest Products Laboratory internal-fan cone kiln.

many units as may be desired. Two kilns can conveniently be placed side by side, or end to end. The fan arrangement shown does not lend itself to the installation of more than two kilns side by side, but it is not difficult to modify the design to permit such installation.

A single kiln unit of this design has been installed by the U. S. Forest Service at the Ozark Nursery, on the Ozark National Forest, Russellville, Ark. A 2-unit installation is being considered for installation at the Chittenden Nursery, on the Manistee Purchase Unit in Michigan.

Drying Schedules

With the advent of fast-drying equipment under complete and automatic control, drying conditions or schedules for the various species of seed cones may possibly be revised. Controlled cone kilns with high rates of uniform circulation of air can operate at lower temperatures, yet produce more seeds at a lower cost under conditions of lowered fire and explosion hazard. On the other hand, the rate of drying and the time in the cone kiln may have a material effect on the temperatures usable for drying, possibly increasing the maximum temperatures that may be used. Toumey (5) indicates that the cones must be properly cured before drying, that they must be subjected to a uniform temperature just long enough to effect their opening, and that the kiln air must be kept as dry as possible. Baldwin (1) suggests that the rational extraction procedure is one of increasing temperature and gradually lowering relative humidity.

Bates (2) has found that four to six months of moderate air drying gives the best yield and quality of seed when lodgepole seed cones are subsequently kiln-dried. He also finds that temperatures up to 200° F. can be used in kiln-drying lodgepole seed cones if they have been given a prolonged period of air drying. Bates further suggests that preliminary air drying of lodgepole is necessary so that the kiln-drying period can be limited to six to eight hours at the elevated kiln temperature; longer heating periods reducing the quality of the seed.

At the present stage, in which optimum drying schedules, conducive to the maximum production in a minimum time of seeds having the highest viability, are being worked out, the need is for a kiln in which a highly flexible drying schedule may be had. The internal-fan cone kiln described here appears to fulfill this need, since it is designed to meet the drying requirements whether the schedule be a constant temperature and relative humidity or a changing temperature and relative humidity.

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FROM MY LOOK-OUT

By D. S. JEFFERS

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BELOW me to the eastward and westward are several small fires. The thin lines of smoke indicate that stump ranchers are burning the brush which they have cleared from patches of land. This effort is the first move toward the reclamation of land from brush and timber for use in the growing of wheat. Beyond this fringe of brush fires are the rolling checkerboarded hills, the yellow wheat stubble, left after the harvest, alternating with plowed fields. The farthest extension of yellow pine (*ponderosa*) into what is now known as the Palouse wheat country is pointed out by the oldest settlers. The burning of brush, the gradual encroachment of wheat fields into timbered areas, and the evidence of struggles for a bare existence on the "stump ranches," contrasting with the prosperity at lower altitudes, raise the perennial question of land use.

Land classification has developed into an intensive program. Many individuals think of it as a relatively recent development, but such is not the case, although in many states it has come to the forefront only quite recently. The earliest example of land classification is found among the pioneers as they marched westward and settled on the newly acquired territory of the young government. They definitely chose areas which offered the best advantages, and in such choice they were guided by the presence of certain trees and the subordinate vegetation that indicated to them valuable land upon which to squat. It was relatively but a few years later that the forest inspectors of the first decade of this century were classifying land, upon a rather broad basis it is true, but nevertheless quite satisfactorily separating potential forest land from that which was of potential agricultural or grazing value.

The Act of June 11, 1906, forced upon Forest Service officers the role of land examiners and classifiers. The herd of land-hungry settlers poured in from all sides, seeking homesteads within the National Forests. Although frequently the Forest officer was rebuked for his conclusions by the decision of the Land Office, the years have demonstrated that with rare exceptions the decisions which the Forest officer made were sound. Many of the submarginal lands which today are tax delinquent and constitute an unsatisfactory rural social problem, the Forest officers of 1906 to 1915 definitely stated were not profitable economic units for the homesteader.

The forester, by training and experience, has been thinking in terms of land values for one-third of a century. His philosophy of land use is that of the long look ahead; he deals in values which require decades to develop. The forester lays his plans with the thought that generations must elapse before his results properly can be evaluated, and the economic conditions of the present are but a factor in the parade of the years. Land values have been as much a resource to him as the timber which demanded his special attention.

From such a training and experience he faces the problems of land use and land classification today. In contrast with the attitude of the forester is the approach of the engineer. He is dealing with exact measurements and the construction of works for the use of mankind. His problems are of the immediate future, prob-

lems of stresses and strains in buildings and structures, problems of construction and maintenance of highways. Many of the land consultants of the Regional and State Planning Boards are engineers. They must depend upon the technical advice of the forester for much of the data which they use.

The agriculturist, whether economist or agronomist, brings to the land-use problem, of necessity, his philosophy that the values of the land rest in the capacity to produce an annual crop for the farmer. Such has been the land-use philosophy of the federal government in its disposition of land, in its countenance of cutting and burning of timber for clearing, in the homestead policy since 1861, and even today in its efforts to chart a course for the administration of the unappropriated public domain.

The approach of the geographer may be stated in the words of Dr. Carl Sauer, of the University of California, who wrote that section of the report of the Science Advisory Board which has to do with "Land Resource and Land Use in Relation to Public Policy." He says: "To keep knowledge within manageable dimensions the concept land has been cut up into segments. The more divided the attention has become, the greater is the difficulty and perhaps the greater the reluctance of the individual investigator or agency to bring the parts together again, yet also the more insistent is the need to see how the parts are related. [We are] . . . concerned with the possibilities of integrating specialized knowledge into a science of the land and of applying it to the economic problems of the land, not as a matter of temporary emergency but as a matter of national welfare that depends on a balanced relation between the people and their land.

" . . . The organized knowledge of lands is geography . . . the field is too vast to be controlled by any individual, probably even by any professional group such as that of the geographers. The recognition of the need of such organization of knowledge, however, is an invitation to a collective task of the first order of importance. This larger science of geography is attainable only by associative effort that has nothing to do with professional labels and rivalries. It is, in short, the obligation to put the pieces together."

The sociologist and the professional economist are concerned with social services, standards of living, taxes, and revenues. Only in a general way does the value of the land as a resource enter into the picture unless it is productive of an immediate and measurable value. Dr. L. C. Gray, of the Resettlement Administration, is reported to have stated recently, before the American Farm Economic Association: "If one had to name the single most distinct characteristic of New Deal land-use programs as contrasted with those of the earlier years, it would probably be their more direct concern with social and human problems." For the Nation as a whole Dr. Gray is undoubtedly correct, but the files of the Forest Service and the Land Office could produce much evidence of the efforts of the Forest officers to turn aside the enthusiasm of homsteaders backed by local residents, as they almost demanded their "right to land" within the National Forests. Again and again the Forest officer was thinking in terms of the economic possibility and, therefore, the social future of the prospective homesteader who felt he must settle on a homestead within a National Forest. Although, in his report, the Forest officer was answering questions which had been submitted in a formal outline, throughout the period of vast development of these homesteads and of observation by the forester it was his definite duty to measure the ability of the homesteader not only to live up to the

requirements of the law, but to establish himself as an independent citizen in the community. It was upon these bases that the forester reported adversely upon claim after claim which far too often was granted by the Land Office.

Trained in field observations over a period of years and backed by his philosophy of the long look ahead, the forester brings to the problem of land use and land classification an approach which no other group of men is able to offer. Because he is dealing with a crop which requires decades to mature; because he recognizes the influences of wildlife, domestic stock, and erosion on bare and cut-over slopes; because he meets intimately the problem of ranchers and homesteaders, stockmen and mining men; the forester has been trained to appreciate the social and economic problems which these various groups face upon the fringes of poor soils as well as upon the better types of land. He recognizes that there is more in the problem of land use and classification than the measurement of evident and immediate values. As a classifier of land the trained forester must underwrite his technical decisions with a breadth of approach to the problems of land use which is quite distinct from that of the trained geographer, the agricultural economist, and the engineer. Each one has his contribution to offer. The mechanics of the making of an inclusive national or regional land plan in this decade will be largely a political technique.

HOW THE NATIONAL SOCIALIST TAX REFORM AFFECTS GERMAN FORESTRY[1]

By R. CLIFFORD HALL

U. S. Forest Service

The German tax system is discussed with special reference to forest property, and recent changes are described. The most important change from the standpoint of private forestry is the reduction of the inheritance tax burden through increased exemptions, which tends to prevent the breaking up of estates and to promote continuity of management.

THE methods of taxing forest land in Germany and the resulting tax burden are subjects of interest to American foresters, partly because the successful and long-standing practice of forestry under private ownership in that country is testimony to the fact that German taxes on forest lands are bearable. These subjects were covered in the recently issued report of the Forest Taxation Inquiry, on the basis of a study made largely in 1931.[2] The facts then obtained seemed to indicate that the property tax burden on forestry in Germany was somewhat lower than in the United States, but that this difference was chiefly the result of the sustained yield organization of the larger German forests, which permitted the payment of taxes out of current income and avoided the accumulation of interest on annual taxes which occurs during periods of income deferment. Taking into consideration personal income and turn-over taxes, the total burden of taxation in forest enterprises has undoubtedly been much greater in recent years in Germany than in the United States, but it is probable that this is also true of other enterprises as well, so that investment in forestry is not handicapped.

A detailed discussion of forest taxation in Germany as affected by the new tax law of 1934 and pursuant regulations is contained in a recently published article by Dr. Kurt Mantel. While no radical changes are reported, there are a few important departures from the methods of taxing forests established under the preceding government. Before considering these changes, a brief explanation of the German tax system with special reference to forest property may be of interest. This explanation, except as otherwise indicated, is condensed from the more detailed description in the abovementioned report of the Inquiry.

Before the World War the sources of taxation were definitely divided between the national government (Reich) and the constituent states (Länder). The national government depended almost entirely on indirect taxes, principally customs and excises. The states obtained most of their revenue from direct taxation, the principal taxes being the income tax, the property tax, and a system of yield taxes (Ertragsteuern) levied on land, buildings, business, and invested capital. These yield taxes do not resemble the American forest yield taxes, as they are based on estimated yield capacity rather

[1]Based largely on an article by Dr. Kurt Mantel: *Die Waldbesteuerung nach der Steuerreform vom 16, Oktober 1934.* (Taxation of Forest Lands According to the Tax Reform of October 16, 1934.) Forstwissenschaftliches Centralblatt, v. 57, serially in nos. 9, 10, 11, 12, and 13, May 1 to July 1, 1935. Acknowledgment is due to Dr. A. H. Krappe for translation of the installments in nos. 9, 12, and 13, and to Louis S. Murphy for critical review.

[2]Fairchild, Fred R., and Associates. Forest Taxation in the United States, pp. 458-483. U. S. Dept. Agr. Misc. Pub. 218, Washington, D. C.

than on actual yield. The political and financial reorganization which came with the republican revolution brought with it material changes in taxation. The income and property taxes were both transferred to the national government, and the tax on yield from invested capital was made part of the income tax. The states retained only the taxes on land, buildings, and business (Grundsteuer, Gebäudesteuer, Gewerbesteuern). In order to make up this loss of revenue to the states, a substantial portion of the revenues which the national government received from direct taxes was turned over to the states and to the local governments. The main outline of the present tax system was embodied in a series of laws enacted in 1925.

The tax revenues of all grades of government from 1925-26 to 1931-32 have ranged from 10.6 to 14.4 billion RM. In the fiscal year 1931-32 they amounted to a total of about 12 billion RM, or 195 RM per capita. Table 1 shows the sources of these taxes and the grades of government (national, state, and local, indicated by the initials N, S, and L, respectively) to which they are assigned.[3]

The most important of the national taxes that affect forest property is the property tax (Vermögensteuer). The property of all individuals and corporations, with a few exceptions, is subject to this tax. It is based on assessed values known as "Einheitswerte" established at intervals of three or more years, beginning in 1925, according to a procedure that is uniform throughout the nation. These assessed values are for the most part capitalized income values, though for certain types of property market value

TABLE 1

ALLOCATION OF ALL TAXES, FISCAL YEAR 1931-32

Nature of tax	Grade of government	Per cent of all taxes
Income tax, corporation tax, etc. (Einkommensteuer, Körperschaftsteuer, etc.)[1]	N.S.L.	25.6
Consumption taxes (Steuern vom Verbrauch und Aufwand)	N.S.L.	16.7
General and selective sales taxes (Steuern vom Umsatz und Vermögenverkehr)	N.S.L.	11.8
Yield tax on land and buildings (Grund—und Gebäudesteuer)	S.L.	11.6
Taxes on rents (Gebäudeentschuldung-(Hauszins-) steuer)	S.L.	11.0
Customs duties (Zölle)	N.	9.6
Business taxes and minor local taxes (Gewerbesteuern etc.)[2]	S.L.	6.2
Transportation taxes (Steuern vom Verkehr)	N.S.L.	3.7
Property tax (Vermögensteuer)	N.	3.1
Inheritance and gift tax (Erbschaft-und Schenkungsteuer)	N.[3]	0.6
Equalization fee (Ausgleichstock)	L.	0.1
		100.0

[1]Includes: Krisensteuer, Bürgersteuer, Verwaltungskostenbeitrag, Aufbringungsumlage, Obligationensteuer, Reichsfluchtsteuer.

[2]Includes: Naturaldienste, öffentliche Lasten der selbstständigen Gutsbezirke, sonstige Besitzsteuern.

[3]Very small portions go to the states and Hanseatic cities.

[3]Statisches Jahrbuch für das Deutsche Reich, 1934, p. 442.

used. The rates of the property tax rior to the recent changes were progres- ve, the 1933 schedule ranging from 0.3 0.8 per cent.[4] However, property the ıcome from which was subject to taxa- on by the state and local governments, hich includes forest property, could not e taxed higher than 0.5 per cent.

The most important state and local x from the point of view of farm and rest owners is the land tax (Grund- euer), in some states separated into land x (Grundsteuer) and house tax (Haus- euer or Gebäudesteuer). In the past has been based on cadastres reflecting eld capacity, the procedure varying in e different states. It is intended that e substitution of the national "Einheits- erte" as the basis for this tax, which ıs already taken place in some states, all become nation-wide.

The national income tax (Einkommen- euer) is a progressive tax on the in- mes of natural persons. The rate of tax pends on the total income and on the mily status of the individual, having direct relation to forest property as ch. The determination of the taxable come from forest property in the case ordinary properties which yield a regu- r annual income presents no special fficulties, but the treatment of extraor- nary cuttings and of intermittent yields s occasioned much controversy.

The corporation tax (Körperschaft- uer) is collateral with the national in- me tax and is levied on the income of rporations. The same principles govern determination of income as in the case natural persons, but the rate of the tax generally fixed at a uniform 20 per cent.

Other taxes which are sometimes of im- rtance to forest owners are the inheri- ce and gift tax (Erbschaft- und Schenk- gsteuer), the sales or turnover tax msatzsteuer), and the land transfer tax (Grunderwerbsteuer). The inheritance and gift tax is based on the national assessed values (Einheitswerte), and the rate varies according to the value of the entire property transferred and the relation of the beneficiary to the testator or donor. It may in some cases impose a very serious burden. The sales tax does not ordinarily impose a very heavy burden, as in forest management the turnover of capital is relatively slow. The rates depend on the size of the enterprise and have been subject to rather frequent change, ranging in the neighborhood of 1 to 2 per cent. The tax on the transfer of landed property is levied at the time of sale and is payable in equal parts by the purchaser and seller. The national tax rate is 3 per cent of the market value of the property and the states and communes may levy a further 2 per cent.

The actual operation of the German tax system in relation to forests may be illustrated by a sample taken by the Reichsverband Deutscher Waldbesitzerverbände (union of forest owners' associations). The taxes for the year 1929-30 on representative forest properties aggregating 147,000 hectares (363,000 acres) located in 11 states were distributed as shown in Table 2.

The taxes which in the aggregate correspond roughly to state and local property taxes of the United States are the property, state land, communal, and miscellaneous taxes. On the above forest properties these taxes averaged 10.5 RM per hectare, or 50 per cent of the net income before taxes and 1.5 per cent of the assessed value.

A review of the more important changes in the tax system made by the present government, based on the information contained in Mantel's article, is now in order.

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[4]Tax Research Foundation. Tax Systems of the World. Fifth edition, p. 209. Chicago, 1934.

Property Taxes

The rate of the national property tax is no longer progressive, but in practice this does not affect most forest properties as the new uniform rate is 0.5 per cent, the usual rate on forests under the preceding law. However, changes in the provisions for specific exemptions result in an appreciable increase in the tax on small forest properties owned by single individuals or by corporations, foundations, and trusts. A small decrease in tax burden results in the case of individually owned properties valued over 20,000 RM, and in case of all properties owned by individuals with children. Mantel suggests that the heavier taxation of corporate property is justified on the ground that individual as against corporate enterprise should be favored, but that a special exception should be made in the case of forest estates which were formerly entailed but are now held by foundations and trusts, on the ground that it is good forest policy to encourage maintenance of such family properties.

The state and local land taxes, originally based on yield capacity, are continued, but beginning April 1, 1937,[5] will presumably all be levied on the uniform value (Einheitswert) assessed as of January 1, 1935, for the national property tax.

Table 2

DISTRIBUTION OF TAXES ON REPRESENTATIVE FOREST PROPERTIES, FISCAL YEAR 1929-30

Nature of tax	RM	Per cent
State land tax	466,248	21.1
Communal tax	445,224	20.2
Property tax	444,963	20.1
Income tax	399,839	18.1
Rentenbank interest tax	126,565	5.7
Sales (turnover) tax	103,684	4.7
Inheritance tax	40,675	1.8
Miscellaneous taxes	182,321	8.3
	2.209.519	100.0

Income Taxes

The taxes on individual and corporate income have undergone considerable change. Special allowances heretofore made in favor of income from agricultural and forestry properties are now omitted. The official justification is that these are uncalled for in view of the measures being taken by the present government to strengthen the economic situation of agriculture and forestry. The effect, however, is a somewhat increased tax burden, especially on the incomes from small and medium-sized forest properties.

The general range of individual income tax rates is not materially changed (8 to 40 per cent instead of 10 to 40 per cent) but the schedule is so altered as to give a marked preference to large families at the expense of single persons and childless couples. In any case, however, the tax may not exceed 50 per cent of the income, a little less than the maximum income tax rate possible on very large incomes in the United States under the Revenue Act of 1935.

The practical operation of determining forest income under the new law is not materially changed. Fluctuations in the value of agricultural and forest land are definitely excluded from consideration in determining agricultural and forest income. The right is recognized, confirming previous court decisions, to determine taxable income by the stand comparison method; that is, by including the value of standing timber in the annual inventory. However, the administrative difficulties involved in using this method are so great that the law still leaves the way open to use the simpler method of comparing annual income and outgo, with special concessions in rates to take care of extraordinary cuttings. It is generally

[5]Finance Department Circular, dated December 22, 1935, as reported in Der Deutsche Forstwirt, 18:13, February 14, 1936, p. 152.

ot to the taxpayer's advantage to in-oke his legal right to use the stand com-arison method.

The special tax rates on income from traordinary cuttings available to owners ot electing the stand comparison method ave been modified. These rates were rmerly 10 to 20 per cent, depending on e amount of the income, but are now anged to a range of 10 to 25 per cent the owner is married, or of 15 to 35 r cent if he is single. The lower rate, ther 10 or 15 per cent, is usually ap-ied, but a higher rate within these nitations may be fixed by administra-e discretion, with regard for the eco-mic situation of the owner. In gen-al the tax burden on income from ex-aordinary fellings is lighter than under e former law, except possibly for single rsons with small incomes from this urce. As heretofore, an extraordinary tting is recognized as such only when e product materially exceeds in value e regular annual cut realizable under stained yield management, and also en the extraordinary cutting is justified sound economic reasons and not made ely for the purpose of tax avoidance. so, if a cutting is occasioned by sal-ge operations following fires, blow-wns, disease attacks, or other natural amities, the tax on the income so oc-sioned continues to be reduced by one-lf.

The new law also embodies the regu-ion previously in effect granting inter-ttently cut forest properties less than 0 hectares in area a deduction of 40 cent from gross income as an allow-ce for costs of operation, provided no ular books are kept and the right to the stand comparison method has not en invoked. Mantel suggests that it uld be better forest policy to extend s privilege solely on the basis of size, order to avoid putting small sustained ld forests under any tax disadvantage. The treatment of taxable income aris-ing from sales of forest lands is modified somewhat. The exemption of 10,000 RM for a given property, or a proportion-ate sum if only a part of the property is sold, is no longer applicable if the taxable gain exceeds this sum. Until January 1, 1938, no taxable gain is recognized except to the extent that the property sold was acquired for a mone-tary consideration since December 31, 1934, or unless it contains a dispropor-tionate quantity of mature timber. The gain is determined by comparison of sell-ing price with cost since 1934, or with the uniform assessed value (Einheitswert) of 1925 if owned before that year, or with book value in case the owner de-termines his income by the stand com-parison method.

Inheritance Tax

The new inheritance tax law, which ap-plies to all inheritances after December 31, 1934, lightens the burden of taxa-tion on bequests to relatives in direct line. The general rate schedule remains unchanged, with a range of from 2 to 60 per cent, depending on the size of the estate and degree of relationship, but the exemptions have been materially in-creased. Heretofore, children and grand-children were granted tax exemption only if the inheritance was under 5,000 RM, and the same was true of a husband or wife in case of a childless couple. All inheritances too large to enjoy absolute exemption were subject to a graduated tax on their full amount. The new law allows exemptions of 30,000 RM for husband or wife and for each child, and 10,000 RM for each grandchild. These exemptions apply to all estates, regardless of their total amount. A surviving hus-band or wife is entirely free from inheri-tance tax when the decedent leaves chil-dren or grandchildren who are offspring of the marriage in question, or when the offspring died in the World War or in the

struggle for the National Socialist cause.

Farm woodlots enjoy complete exemption from inheritance taxes, through a provision under which the entire farm and all its appurtenances may be passed on to the heir tax free. In any case, the effect of the liberal exemptions is that many small tracts (up to about 100 hectares) may be transferred tax free. These exemptions also result in substantial relief to medium and large estates. As the weight of inheritance taxes constituted a danger to private forest ownership, especially in the case of the larger estates, the lightening of this load is an important step in favor of maintaining private forestry.

Assessment of Forest Properties

The procedure for assessing the uniform value (Einheitswert) of forest properties as a basis for all taxes dependent on property value has not been greatly altered. The date of the current assessment is January 1, 1935, and it is expected that the future interval between assessments will be six years.

The unit of valuation remains the management unit, as determined by location, economic unity, and common management plan. All appurtenances of the enterprise, such as necessary buildings, tools, and normal working capital, are included. Forest nurseries are also included where their main purpose is to supply planting material for the property rather than for outside sale. Each unit is appraised at its net income multiplied by a factor fixed for the present at 18 for forest property, which implies an interest rate of 5.5 per cent. However, this capitalization factor has no direct connection with the actual interest rate and gives a materially lower result than actual market value. Its use is a special concession to forest property, since the factor generally used for other property subject to valuation on an income basis is 25.

The most important change in the new law is that the procedure of valuation by age classes, formerly applied only to forests with an irregular distribution of age classes, is now applied to all forests, with certain minor exceptions noted later. Under the former regulations, by which normal and approximately normal forests were assessed by one method and irregular forests by another, it was often difficult to draw the line between the two, and inequalities were bound to result. The Minister of Finance, with the aid of the forestry division of the valuation council, determines the value per hectare of normal forests corresponding to specified conditions of species, site quality, density, and price per cubic meter of Derbholz (wood more than 7 centimeters or 2.76 inches in diameter at the small end). These valuations are based on average prices for forest products realized in the fiscal years 1925-26 to 1932-33, inclusive. To apply these tables to selection forests the procedure calls for determining area equivalents for each age class; also mixed stands must be reduced to their area equivalents in terms of pure stands. The value per hectare for each age class is derived from the average value of the corresponding normal forest by percentages read from tables, as in the 1931 assessment. However, in the tables issued for the new assessment a separation by rotation periods is no longer made, and greater differentiation between site quality classes has been introduced.

Small forests without management plans, usually with intermittent yield (farm woodlots and estate forests up to about 50 hectares in area) were assessed in 1931 by a simple method of applying average rates based on the age class procedure. Little change is called for by the new law. As a rule species, age, and area are obtained from the owner, while site quality, density, and average price of the products are determined according to the growth and price districts established by the state finance offices. If no other density is indicated, 0.8 is assumed instead of 0.7 as in the 1931 assessment.

heretofore, special conditions may be cognized by additions to or reductions om the standard figures.

The new law empowers the Minister of nance to prescribe rates for the assess- ent of simple coppice, coppice with ndards, and protection forests. Ac- rdingly regulations have been issued ebruary 28, 1935) with special provi- ons for these forms. The rates for pine protection forests have been fixed 45, 90, and 150 RM per hectare for or, medium, and better situations, re- ectively. Tables are provided for sessment of coppice based on the aver- e volume yield and its value per cubic eter, this being a departure from the ual age-class procedure.

In discussing the results to be expected the new assessment, Mantel calls atten- on to the need of tax officials for in- eased cooperation of forest valuation perts, as indicated by past experience. hile he is critical of the application of e age-class procedure to assessment of lection forests, he concludes: "If the sessment of forest property is carried t with the proper sense of proportion, e age-class procedure, which is now be- g used almost exclusively, will, upon the hole, prove satisfactory. The detailed timate of the growing stock according forest species, site-quality class, density, d age class offered by this procedure, connection with the consideration of e actual wood prices, guarantees an sessment having due regard to the pecu- r character of each individual property. he carefully worked out procedure, pro- ding numerous valuation aids, insures proper functioning. A special advan- ge of the age-class procedure is the mination of uncertain and doubtful ses for calculation, for example, the te of interest and the appraisal of future elds. In comparison with these advan- ges, the disadvantages of the present assessment procedure, such as the neglect of actual income from cuttings and the results of production control, the uncertain or overvaluation of young unmerchant- able stands, etc., lose their importance."

Mantel also forecasts that the evolution of assessment procedure together with the transition to uneven-aged forests of mixed species will lead to greater consideration for the volume of the diameter classes and for the increment fixed by production control. It is expected that a detailed forest survey covering both soil and grow- ing stock, corresponding to a survey of farm soil resources that is now under way, will in the future afford a detailed factual basis for taxation as well as for other economic purposes. If this expec- tation is realized it will be possible to make a much more accurate assessment of very many small properties.

Conclusions

In general it seems that the tax situa- tion of the German forests is not mate- rially changed under the new tax law, except for the relief granted in respect to the inheritance tax. This relief is im- portant both because of its direct effect and its indication that the new gov- ernment intends to facilitate the mainte- nance of privately owned forest property. The earlier limitations on taxation of publicly owned forests are maintained; in the future, national and communal forests are specifically exempted from all direct taxation.[6] Otherwise the changes, apart from those depending on the family status of the owner, are intended mainly to bring about greater consistency and efficiency in tax procedure. Mantel indi- cates that the present law is not intended to be definitive, but is regarded as only a step in the direction of a tax system that will better express the social and eco- nomic purposes of the government.

[6] Fairchild (see footnote 2) notes a discrepancy between the law and what appears to be practice in respect to taxation of publicly owned lands, which may or may not continue der the new dispensation.

A CORRELATION OF EROSION WITH LAND USE AND SLOPE IN THE NORRIS DAM WATERSHED

By A. R. SPILLERS

Forest Survey, Southern Forest Experiment Station

IT IS only within the last few years that people awakened to the widespread destruction of agricultural soils caused by uncontrolled erosion. Today, through the Soil Conversation Service, the Civilian Conservation Corps, the Tennessee Valley Authority, and other agencies, we are striving to stop the washing of our valuable soil into the streams, and eventually into the sea. It is a difficult task, and success will depend largely upon our ability to formulate and put into effect a land-use program that contains definite provisions for preventing erosion.

When field crews of the U.S. Forest Service in 1934 surveyed[1] the Norris Dam watershed area which lies above Norris Dam along the Clinch River in eastern Tennessee and western Virginia, they also obtained data on land use and soil erosion. At intervals of every 10 chains along parallel compass lines 5 miles apart the crews laid out quarter-acre sample plots on which they recorded data concerning land use, slope erosion,[2] and forest resources. The correlation of the erosion with conditions of land use and with slope is the purpose of this article.

A bird's-eye view of the Clinch-Powell drainage area discloses a rough, hilly country of 1,802,300[3] acres, about 175 miles long and averaging 20 miles wide, about half of which is cleared land and the other half forested. About 24 per cent of the entire area is cropland in cultivation, while 3 per cent is idle and abandoned farm land, and 23 per cent is pasture. With respect to slope the entire area may be classified as follows: 19 per cent with gentle slopes,[4] 33 per cent with moderate, and 48 per cent with steep slopes.

Figure 2 shows that about one-half of the land with gentle slopes has been taken over for cultivation. Obviously, the farmers would rather till lands with such gradients than those with steeper slopes. However, since all farmers do not own a sufficient acreage of the more nearly level land, over 11 per cent of the steep slopes is also being tilled. Abandonment takes place first and most frequently upon the steep lands; the proportion of idle and abandoned area to cropland in cultivation is over four times as great upon the steep slopes as upon the gentle gradients. About 27 per cent of the land on gentle slopes and 20 per cent of the land on steep slopes have been taken over

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[1]Part of the National Forest Survey authorized under the McSweeney-McNary Act of 1928. This study was made by the Southern Forest Experiment Station's Survey Staff, under the Supervision of I. F. Eldredge, Regional Survey Director. See Release No. 7.

[2]Since this survey was made, much of the erosion has been checked.

[3]Not including the area in water, towns, etc.

[4]Slopes are classified as follows:

I. Gentle (0-15 per cent gradients);
II. Moderate (16-30 per cent gradients);
III. Steep (Over 30 per cent gradient).

or pasture. The forest is largely concentrated on the steep slopes; only 21 per cent of the gentle slopes, but 66 per cent of the steep slopes is covered by forest.

Rainfall in this region often occurs in torrential downpours, and the hillsides are so steep that surface run-off often attains high velocities.

The soils of this watershed vary considerably in depth and composition. Owing to these and other factors, some of the soils are more readily eroded than others. Approximately two-thirds of the area has relatively deep soils derived from limestone, which do not wash easily. The remaining one-third of the area has clays or light sandy clays derived from shale and sandstone. It is on the latter soils that erosion is particularly destructive. Data concerning soil origin was not recorded for each field sample plot; therefore no separation by soils was made as to erosion. Thus this study cannot compare the erosion on soils derived from limestone with that on soils derived from shale or sandstone. The data, however, do give a comprehensive picture of the erosion by land use and slope classes for the entire watershed.

Effect of Land Use on Erosion

It is recognized that some soil erosion is occurring upon the entire watershed, but this paper is concerned only with the noticeably marked or destructive stages, including serious sheet,[5] shoestring,[6] and gully[7] erosion. About 16 per cent of the

Fig. 1.—Land suitable only for forests. If cleared these steep slopes would erode rapidly. (Headwaters of Clinch River.)

[5]Soil is washing off from a generally smooth surface.

[6]Soil surface is cut into, and a system of small, shallow, branching gullies not over 2 feet deep is formed.

[7]Soil surface is cut into gullies more than 2 feet deep.

entire watershed shows one or more of these stages of erosion. Some form of marked erosion is found upon 24 per cent of the cropland, on 28 per cent of the idle and abandoned land, on 23 per cent of the pasture, but on only 7 per cent of the forest land. In many places where erosion is found in the forest it is caused by run-off from cultivated fields situated higher up the slope. Often erosion is found continuing in a newly established forest which had recently been an eroding abandoned field.

Of the three different types of marked erosion, the gully form represents the most advanced stage. Obviously, gullies are found oftener upon the idle and aban doned land than upon any other class About 11 per cent of all the idle and abandoned land has gullies, as compared to about 4 per cent of the pasture, 1.4 pe cent of the cropland, and 1.2 per cent o the forest land. The reason why crop land in cultivation shows such a smal proportional area affected by gullies i probably because it is abandoned abou as soon as gullies are formed. In con sidering the degree of erosion in the lan use classes, about 39 per cent of th eroding land in the idle and abandoned area has gully erosion, as against onl 6 per cent of the eroding cropland area

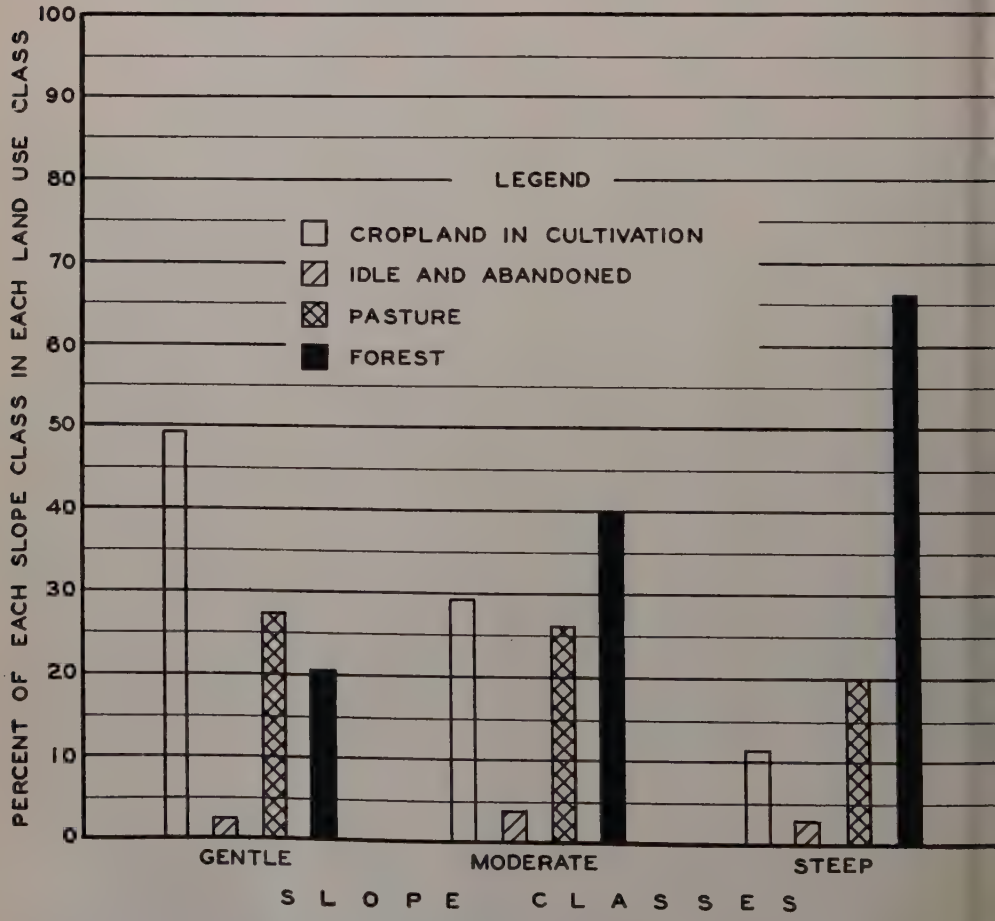
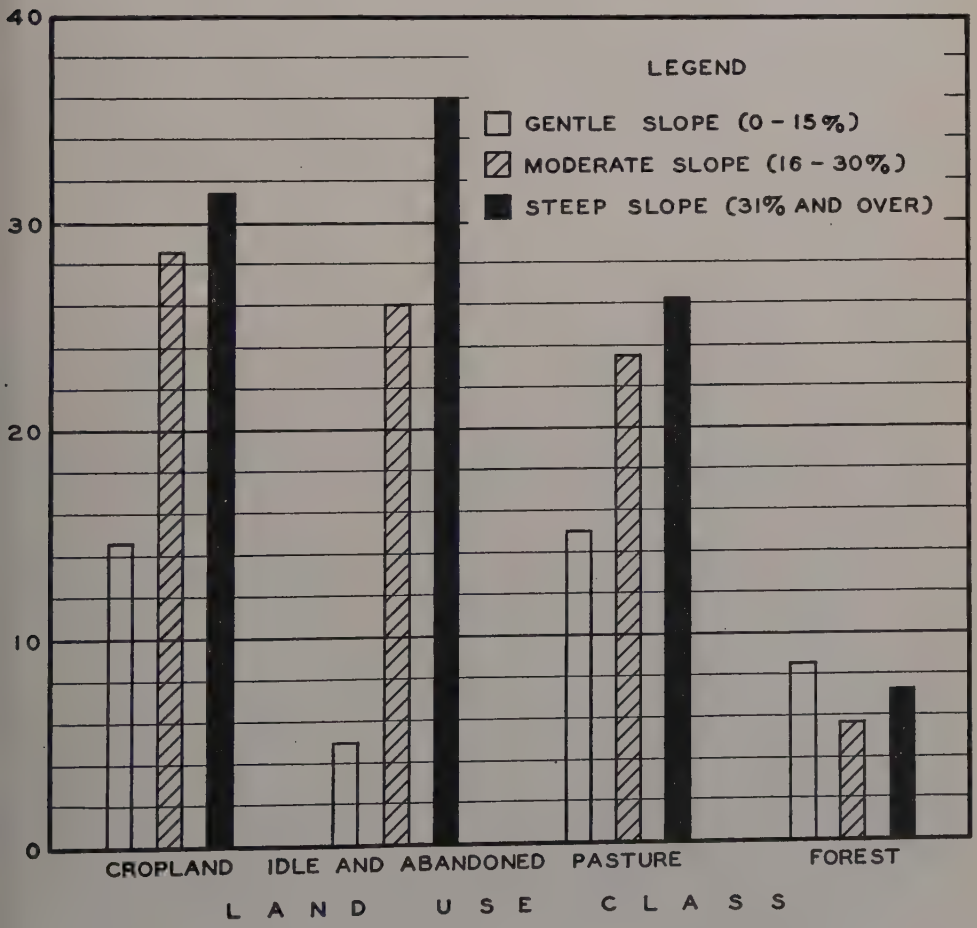


Fig. 2.—Proportion of each slope class in each land use area.

The common farming practice is to ow the land to pass through a cycle use-stages, starting with the natural rest. Forested areas are cleared and ltivated or pastured until erosion be- mes serious. The fields are then aban- ned and in time reforest naturally. ntil a grass or tree growth is estab- hed, erosion continues after cultivation abandoned unless check dams or other ificial run-off control is resorted to.

Effect of Slope on Erosion

Slope, as well as type of land use, s found to influence the development and extent of erosion. In comparing the effect of different land uses upon erosion it must be remembered that, generally, the land in cultivation is found upon the gentle or moderate slopes, while the forest predominates upon the steep slopes. Only 23 per cent of the cropland is upon steep slopes, yet 24 per cent of the cropland area is eroding. Figure 3 shows that about 15 per cent of the cropland on gentle slopes has marked erosion, with 29 per cent on the moderate slopes and over 31 per cent on steep slopes. In the idle and abandoned class, about 5 per cent of the area on gentle slopes shows marked erosion, as compared to



. 3.—Prevalence of marked erosion in each land use as affected by slope.

Picture taken by Mr. G. H. Lentz, in charge of erosion control work for T.V.A.

Fig. 4.—Marked gully erosion upon a steep abandoned field in the Clinch River drainage.

Fig. 5.—An abandoned field naturally reforested. Only a few years ago the lower area shown in this picture was cultivated, then ruined by erosion and subsequently abandoned. Now grass and pines are holding the soil in place and checking the water run-off. (Southern part of the Norris Dam watershed.)

6 per cent of the steep slopes. In the orest, slope seems to have little or no ffect upon the prevalence of erosion.

Only 7 per cent of the steep forest land as marked erosion, and only 9 per cent f the gentle slopes.

With the exception of the forest land, s a rule the steeper the slope the greater the severity and extent of erosion. Inuding all land-use classes, marked eroon is taking place upon 13 per cent of ie area on gentle slopes, 18 per cent on ioderate slopes, and 15 per cent of the eep slopes. The large amount of forest nd on the steep slopes accounts for the elatively small percentage of eroding nd on the steep gradients.

Conclusions

1. About 16 per cent of the entire rea of the Norris Dam watershed shows arked erosion.

2. The proportion of eroded land on eared areas is 3½ times as great as it upon the forest land.

3. The degree of slope has a notable ffect on both the extent and severity of rosion on cleared land; under forest cover the effect of slope is almost negligible.

Recommendations

1. On land similar to that found in the Norris Dam watershed there should be a rational adjustment of land use to slope, which will involve the relocation of cultivated fields from steep to gentle slope, which will involve the relocation agricultural methods such as strip cropping and terracing will assist in preventing or checking erosion on croplands, and that the development of sodded pastures on cleared areas subject to erosion will often have the same effect. On the steep slopes, these methods have but limited application. The best and most permanent erosion control agency upon such slopes is forest cover.

2. Artificial erosion control work should continue where erosion has already advanced to a serious stage.

3. Cultivated fields that are upon steep slopes should be returned to forest, either by natural or artificial means.

4. The forest cover on steep slopes should be maintained and protected from fire.

FOREST PRODUCTS ASSOCIATION, INC.

By K. E. BARRACLOUGH[1] and C. S. HERR[2]

FORESTERS for many years have considered the problem of cooperative marketing of forest products so as to stabilize the income of woodland owners and at the same time place the woodlands on a sustained yield basis. It is the opinion of many foresters that if such organized marketing of forest products can be attained, this will lead to good forestry management on small private holdings with a minimum of regulation by the state and federal governments.

With such a purpose in mind, the New Hampshire State Extension Service has attempted for several years to aid farmers in Coos County in marketing their forest products cooperatively. Since 1929 35 carloads of Christmas trees have been shipped from Coos County to New York City and other metropolitan centers by a Christmas tree association sponsored by the County Farm Bureau and the Extension Service. This informal Christmas tree agency was established for the purpose of developing an interest in the special production of Christmas trees for market, and for the purpose of securing for the farmers a better price for trees than was received through ordinary channels. The association succeeded indirectly in increasing the general price, and directly brought in $8,000 of new revenue which would not otherwise have been received. Approximately 100 farmers have cooperated in this marketing project.

Before discussing further the marketing of forest products, it is important to consider the economic situation that has existed from 1929 to the present time in the upper Connecticut and Androscoggin Valleys, which includes Coos ond Essex Counties of New Hampshire and Vermont. Farmers in this region depend largely upon the sale of milk, potatoes, pulpwood, Christmas trees, and maple products for cash income. Returns from dairying have been very low for several years. The market for potatoes has been poor. Many farms which have been in the same family from 20 to 100 years without mortgage are at present from one to three years behind in taxes, and have other obligations unpaid.

The census of 1930 shows that approximately 21 per cent of the total 1,559,040 acres of land area in the two counties is in farm land, and that 47 per cent of the farm land is woodland. The total woodland acreage for the two counties is approximately 1,225,000 acres. The census of 1930 indicates that 21,929 cords of pulpwood were harvested from farm woodlands in Coos and 6,191 cords in Essex County, including both hardwood and softwood. This total cut of 28,120 cords in 1929 represented a value at current prices of $224,960. This yearly cut for the region fell rapidly following 1929, and at times little or no market existed for pulpwood at all. Since 1933 the market has been more active, and pulpwood is moving into market.

It appeared that up to 1929 a balanced relationship existed between agriculture and industry in the area. The farmers were fairly prosperous, and were able to provide work for farm hands on the farms during the summer season and in the woods during the winter. Other labor found work on pulp and lumber companies' lands and in the mills. With the drastic drop in agricultural and forest products prices following 1929, along with other economic maladjustments, the farm-

[1]State Extension Forester, New Hampshire.
[2]Extension Forester, Lancaster, N. H.

rs in the region were soon in difficulties. Many of the men who labored in the pulp nills, in the woods, and on the farms vere thrown on the relief rolls.

The pulp mills were operating on greatly reduced schedules, with large supplies f high-priced wood in their yards. Newsprint dropped from $75 to $36 per ton. Like many industries, the pulp companies vere overcapitalized and often carried xcessive overhead charges.

When confidence was later restored and usiness improved, the mills increased heir production, but were unable to purhase wood from farmers in the region. This made the condition of the farmer till more critical.

After using the supplies of wood on and, the two principal mills in the reion started to cut wood from their own ands with the aid of state and federal inancing. Before the 1929 period the nills had purchased wood from farmers nd other small land owners through conractors, who usually figured on a commission of about $1 a cord. The contractors, following the break in the market, had little or no resources of their wn, nor could they secure credit from anks or pulp companies to get into the usiness again. Consequently, as a result f low prices for agricultural products nd no market for pulpwood, well over 9 per cent of the farmers in the region vere in serious financial difficulties.

During the winter of 1934-35 representatives of the state and federal extension ervices approached one of the pulp comanies in the region, asking the owner to urchase pulpwood from the farmers on he condition that the New Hampshire Rural Rehabilitation Corporation would id the distressed farmers in the area to inance the marketing of the wood. This Rehabilitation Corporation was organized hrough the efforts of F.E.R.A., and was ater taken over by the Federal Rural Resettlement Administration.

The pulp companies consented to such an arrangement, agreeing to pay the current market price for pulpwood delivered by farmers to their mill yards. One hundred thousand dollars was granted by the F.E.R.A. to the New Hampshire Rural Rehabilitation Corporation for the purpose of financing the self-liquidating pulpwood project. Some $65,000 has actually been turned over to the State Director of Rural Rehabilitation to finance the project.

As a result of this effort, some 75 farmers have cut nearly 6,000 cords of pulpwood and are now (winter of 1935-36) delivering the wood to the mills. The cost of supervision of the project to the federal government amounts to about $1 per cord. Through a memorandum of understanding between the State Rural Rehabilitation Corporation and the State Extension Service, the State Director of Rural Rehabilitation employed a technical forester to take charge of the project, and an effort was made to have the clients conform with forestry rules as recommended by the State Extension Service.

The pulpwood project in general was well received by the farmers and the pulp companies. But because of regulations applied by the rehabilitation division, it was impossible for a farmer to become a client of the Rehabilitation Corporation unless he was on relief, or could prove upon investigation that he was in dire straits financially. The New England farmer is a proud individual, and many would not submit to the detailed investigation. As a result, many farmers requested that a more orderly and business-like way be developed for marketing their forest products. One hundred and eighty-two farmers signed a petition in September, 1935, making such a request.

Following several conferences between the State Extension Service and the federal and regional offices of the Resettlement Administration, the Extension Service was assured that every effort would be

made to secure a federal loan of $100,000 for a forest products association, if and when organized. On the strength of such support from the Resettlement Administration, the State Extension Service during November, 1935, called a meeting of farmers in the region to determine the general sentiment. Nearly 300 farmers attended and organized the Forest Products Association, Inc.

The Association is organized under the cooperative law of the state of New Hampshire. It is organized without capital stock, with its principal place of business at Lancaster, N. H. The property rights and interest of each member are determined in accordance with the value of the products marketed by him through or by the corporation. The purpose of the corporation is to create and maintain an organization for the marketing, selling, processing, grading, manufacturing, storing, handling, or utilization of forest products or by-products. Also, the corporation can engage in any activity in connection with the purchase, hire, or use by the members of the corporation of supplies, machinery, or equipment, or in financing any of the activities set forth. Each member has one and only one vote.

The by-laws as adopted by the incorporators November 21, provide for 11 directors, to be elected annually by the members. The by-laws provide that a farmer becomes a member of the Association upon signing a marketing agreement, which must also be accepted by the Association. There is no membership fee.

About 200 farmers have signed marketing agreements. The signing of the agreements was accomplished through community meetings and personal contacts conducted under the direction of the Extension Service. The marketing agreement is a lengthy document and binds the member and the Association in close cooperation.

The directors decided it was best to handle only pulpwood at the start. A member is obligated to market all of the pulpwood he sells through the Association. A member can withdraw from the Association at the end of one year upon written notice by registered mail. The Association is obligated to a member for three years unless he withdraws his membership as explained. Also, a clause appears in the marketing agreement that in case the producer fails to deliver his products to the Association as agreed, he is subject to a fine of $1 for each cord of pulpwood not delivered.

In order to meet the necessary overhead expenses, it is estimated that the Association will need to handle annually between 15,000 and 17,000 cords of pulpwood and about 15 carloads of Christmas trees. Based upon the combined experience of the directors and the experience gained in marketing pulpwood for 75 rehabilitation clients, the opinion was that 10 per cent deducted from the market value of the wood delivered at a mill will care for the overhead. It is estimated that about 60 per cent of this amount will be used for current expenses such as the salary of the manager, necessary field and clerical assistance, and travel, office, and other expenses. The remaining 40 per cent will be used to retire the loan, for interest charges, and for building a reserve. The marketing agreement provides that such expenses shall not be in excess of 10 per cent of the selling price.

In the agreement provisions are made whereby the Association can make loans to its members. Money loaned by the Association to its members will be at the rate of interest charged at the local banks. The amount that can be loaned to a member cannot be in excess of 60 per cent of the market value of the products securing the loans, except that loans may be made on products which have been transported

o the truck-road in an amount not in xcess of 70 per cent.

The establishment of sustained yield n the farm woodlands to be under the ontrol of the Forest Products Association, nc., has been paramount in the minds f the sponsors. The following clause ppears in the marketing agreement:

"The Association shall formulate and pprove principles of forest practice which vill conform with the applicable prin-iples of forest practice, including such evision thereof as may be made from ime to time as recommended by the de-partments and agencies of the United States or the state of New Hampshire in harge of forestry, and will advise and ssist the producer in the application hereof to the woodland from which the products are obtained.

"The producer will care for and use aid woodlands in accordance with said principles and practices and, except as nay be required for his own use, or as is elsewhere provided herein, will not cut ny timber except in accordance there-vith."

The State Extension Service also has a nemorandum of understanding with the Forest Products Association in reference o the care of the woodlands under its urisdiction. The memorandum reads in part as follows:

"The State Extension Service agrees: That the principal object of such coopera-ion shall be to provide technical assist-nce in the good forest management of he woodlands of members when their for-st products are being marketed by the Association. Good management of wood-ands consists of adopting scientific prac-ices in the care of growing stock, and he cutting of merchantable growth with he purpose of sustaining the yield and quality of suitable forest products.

"To provide the Forest Products Asso-iation with technical assistance in deter-nining the annual growth of forest prod-ucts on woodlands of the members so that the Association may determine the maximum or periodic cut on the wood-lands of its members. Since such data can only be obtained from field studies, the Extension Service will seek the cooperation of the New Hampshire Agricultural Experiment Station, the Northeastern Forest Experiment Station, and other interested public agencies in making such information available to the Forest Products Association, Inc.

"The Forest Products Association agrees: That every effort will be made through its manager to have its members develop the policy of sustained yield on their wood-lands, and will ask and seek the technical advice of the New Hampshire State Exten-sion Service on such matters.

"That over any five-year period start-ing January 1, 1936, the total annual cut will not exceed the total annual growth on the woodlands of its members in the state of New Hampshire. . . . . ."

The Northeastern Forest Experiment Station has started a pulpwood cost-of-production study on the farm woodlands of several farmers now cutting wood for the Rehabilitation Corporation. The New Hamp-shire Agricultural Experiment Station and the Northeastern Forest Experiment Station are cooperating in working out a plan for a field study so as to determine the annual growth of forest products on the farm woodlands of Coos and Essex Counties. The Agricultural Experiment Station also laid out several one-fourth acre plots during the fall of 1935 on areas where pulpwood was cut by farmers during the spring and summer of that year, for the purpose of determining conditions that best encourage the natural reproduction of spruce.

With a membership of about 200 farm-woodland owners, the Association has un-der its control some 60,000 acres of wood-land. These members have indicated that they have approximately 150,000 cords of

merchantable pulpwood for sale at the present time, and they would like to market annually approximately 20,000 cords. The Forest Service uses the figure of one-sixth of a cord per acre as the annual growth of pulpwood for northern New Hampshire. Applying this figure to the 60,000 acres under the control of the Association at the present time, the annual cut would be 10,000 cords. If the Association is successful in applying forest practice rules on the lands of its members, it should be possible eventually greatly to increase the annual yield per acre. Also, it is quite possible for the Association to more than double the farm woodland acreage under its control, thus increasing the possible annual cut materially and still have the region on a sustained yield basis.

The Forest Products Association, Inc., was granted a $100,000 loan by the Resettlement Administration February 1, 1936, at 3 per cent interest. The security for the loan is the signed marketing agreement and security advanced by the Association at the time individual loans are made to the members. The Association does not pay upon the principal for three years, but thereafter agrees to retire the loan at the rate of not less than $3,000 annually. The money has been placed with local banks approved by the Resettlement Administration under certain restrictions set forth by it. The Association must submit quarterly reports to the Resettlement Administration as to its activities. The Resettlement Administration has the right to appoint an administrator to conduct the business of the Association, if in the opinion of the Administration the funds are being mismanaged.

At the time the Association accepted the loan from the Resettlement Administration, the directors considered several candidates for manager, and will employ within the next few days a man well qualified to handle the work. The first problem the manager has before him is to interview the pulp companies and make suitable contracts for marketing pulpwood. The success of the Association depends upon close cooperation with the pulp companies. The companies can afford to treat the Association in the light of a middleman, since they are relieved of all responsibilities and risks in buying wood in many small lots. The members of the Association must recognize that their active support and cooperation in the marketing of pulpwood in the best interests of the entire membership can best assure the success of the Association.

The cooperative has been organized at a time when prices are low, and at a time when many wood-using industries are forced to reorganize. The demand and the price paid for pulpwood and for other forest products will increase as the general condition of the country improves. Wood-using industries will continue a permanent part of New England economic life, if proper recognition is given the policy of sustained yield as emphasized by the newly organized Forest Products Association, Inc.

The cooperative marketing of forest products is a pioneer effort, and much valuable experience is being obtained. The Association has been favorably received by the farmers and the business men of the region. If woodlands in private ownership are to continue to grow suitable forest products for use, every effort must be made to encourage the practice of forestry on such lands. Through a forest-products cooperative-marketing organization where equal consideration is the right of each member, it is possible that a new interest may develop in the proper management of privately owned timberlands.

ALLEGHENY SECTION COMMITTEE REPORT ON LAND POLICY

IN these days of "national planning," "integrated land use," wholesale acquisition programs, and large federal appropriations, it seems wise to discuss the whole question of land use and to set forth some principles which, we believe, should govern. The problem of tax delinquent lands is only a part of the problem, and until we agree on the general principles it seems idle to attempt a solution of this one phase.

Tax delinquent lands are symptoms of an economic disease which may be entirely localized and therefore can be cured by a local reform; or the disease may be epidemic in character, to which some general quarantine measures are applicable. In either case, the problem requires careful and detailed study which the Committee has been unable to devote to it. We believe also that its solution is tied up with the whole problem of proper land use, and it would therefore be presumptuous on our part, with the inadequate information available, to attempt to give the answer.

We, therefore, with your permission, will proceed to outline the general principles and to propose a plan of procedure for the future.

As an approach to the problem certain premises or principles will be found useful, and we suggest these:

1. A wise use of our land resources is essential to the public welfare, and some degree of public control to insure proper use is essential.

2. The responsibility of foresters is for the wise use of the "wild" land which is or should be forested. "Wise use" is any method of treatment which keeps such lands productive of the product to which they are chiefly suited or for which they have been set apart, whether it be timber, wildlife, recreation, or scenery.

3. So long as the land is kept productive or can be made productive, its ownership is not a matter of public concern.

Foresters are therefore concerned with the job of keeping wild lands productive; and unless the transfer of title from private to public ownership is clearly the essential first step in accomplishing that objective, this step should not be undertaken, because:

a. The acquisition of land by public authorities creates a public burden, and often only increases the tax problem on remaining lands.

b. A large proportion of the land acreage in government ownership is undesirable because it tends to build up a paternalistic system contrary to the individualistic ideas of life with which the great majority of the American people are believed to be imbued.

It follows that our first attention should be directed to the means of accomplishing the end sought without disturbing the status of present ownership, or with the least possible disturbance. The solution of our problem of keeping wild lands productive by transferring ownership to the federal or state government is the easiest course, but it may not be the wisest one. Too often the public enthusiasm, and sometimes the public money, is exhausted in making the purchase. Certainly unless there are adequate means of doing something with the lands after the public acquires them, we have accomplished nothing by transferring the title. Fire protection can and should be given all wild lands irrespective of ownership.

What, then are the classes of land which experience and the foregoing principles clearly indicate should be acquired by the public?

1. The mountain forests protecting the headwaters of navigable streams are clear-

ly, and by common consent, allocated for public ownership. The interpretation of what should be included in this class is also, by common consent, very broad, and includes almost any mountain country from the Ozark hills to the peaks of the Rocky Mountains.

2. Areas needed for scenery and recreation,—the National and State Parks, wilderness areas, etc.

3. Game and bird refuges, hunting grounds.

4. Pauper lands,—those which, because of barrenness, private citizens cannot be induced to acquire or retain, and they therefore become a public charge. If such lands will bear tree growth, they naturally fall into the forester's lap.

5. Special areas not included in the foregoing, such for example as historic ground or land needed to control erosion, demonstration or "research" forests, forest land required for a cooperative undertaking in sustained yield management, etc.

Mountain forests and recreation and wildlife areas constitute the principal classes of land where public ownership can hardly be questioned. Beyond these classes, it seems to the Committee that public ownership should not extend, except where it can be justified by special conditions. Generally speaking, we believe the flat lands such as are found in the Lake states and throughout the South (unless they fall into the "pauper" class) should be left for private ownership, and that it is our job to work out conditions favorable to such ownership. We take this position partly because it is believed to be undesirable, for reasons which are quite obvious, for the government to own a majority of the land resources. If public ownership is held to the classes of land listed—to the field where government ownership has proved wise—the percentage will be kept to a safe figure and yet will be large enough to serve all purposes.

We would not absolutely preclude public ownership of the flat lands even where the purpose is timber growing, but certainly the reasons should be clear-cut and convincing and sufficiently confined to local conditions so as to preclude the possibility of wholesale ventures. Demonstration forests are perhaps the best example; or eroded lands which must be reforested immediately.

The line between areas suitable for state and federal ownership is indistinct, and in the opinion of the Committee immaterial. There is an ample field for both agencies, and the division of territory and activity is a matter of understanding and agreement rather than general principles. Usually, but not always, the high mountain slopes and forested watersheds of navigable streams have been considered the rightful sphere of the federal government. We believe there has been no serious difficulty in the past on this point.

We appreciate that the present policy of federal acquisition of lands does not seem to conform strictly to the above principles, and to the extent that it goes beyond them, we question its soundness.

Who should acquire tax delinquent lands? It is impossible to answer except when stepped down to specific localities. Our general answer would be to try first to bring about conditions favorable to private ownership. Our economic system has failed in some respects, otherwise the lands would not be tax delinquent. If a public need exists for such lands because they fall into one of the classifications previously mentioned, then by all means let us get them into public ownership as quickly as possible, but if such need does not exist, then our efforts should be to find some other solution to the problem. If they do not properly belong in public ownership, the immediate need is some sort of temporary detention quarters until the doctors can diagnose the

disease and offer a cure. It is the proper function of foresters to take a prominent part in finding a cure and applying it.

The Committee takes the position that it is well to go slow with public acquisition of wild lands except where they are clearly in a class where no question can be raised concerning the policy involved. We believe that there is an ample field for public acquisition of forest lands even if restricted as already indicated. We further believe that forestry on privately owned lands is possible and should be encouraged. We recognize the present handicaps, and admit that the prospects in many parts of the country are not encouraging. Nevertheless we believe that a solution can and must be found. It is more likely to be found if we recognize the limitations of the public purse, the dangers involved in any wholesale purchase policy, and firmly set limits within which private ownership must not be disturbed.

The logical procedure would seem to be:

1. Use every effort to insure a uniform and effective system of public control of forest fires, insects, and diseases. We hold that this is properly a public function; and until, by sufficient development of public control machinery and educational preventive sentiment, the private owner is assured of reasonable safety to his timber, there can be no worthwhile industrial forestry.

2. Make a real effort to remove the handicap of high taxes and high carrying costs which are now acknowledged to be generally prohibitive.

3. In the meantime, watch the present tendency to wholesale public purchase of forest lands, particularly the best growing lands, and, if necessary, exert pressure to keep the policy within bounds. It seems strange that such a precaution would be needed, but in these changing times we need not be surprised at almost any development.

For the first and the last, we must depend upon the leaders in the Society and the profession. A land policy committee could watch the trends and point the way and keep things stirred up where stirring is needed. To this end we recommend the continuance of a general land policy committee, preferably a new one every year.

In addition, we suggest a land-use committee for each state represented in the Allegheny Section. Their purpose would be to study the situation locally, with particular reference to removal of the handicaps to private forestry. A good start would be the study of the Fairchild Report (Misc. Pub. 218, Department of Agriculture) and its application to local conditions. The purpose would be to determine the best procedure in tackling the forest taxation problem and to propose a program which all foresters in each state could back.

We want to remind you again that the solution of the tax delinquency problem is bound up with the whole problem of land use, and cannot be solved as a separate entity. An understanding of the problem must be based on local studies—sample plots, is the familiar forestry term. The Soil Conservation Service is taking such plots all over this country. The U. S. Forest Service has or can get more or less detailed information. The extension foresters and agricultural agents are available. Many state forestry organizations can help, and various taxation and government reform organizations are springing up.

Just how and where to make the first attempt to remove the obstacles to private forestry must be left to the decision of each committee. With this general advice, we turn back the problem to the Allegheny Section, and request that the present Committee be retired.

This report is not to be interpreted as opposing a proper and reasonable expansion of public ownership of forest lands under the general principles outlined.

JOHN F. PRESTON, *Chairman.*

THE PROGRESS OF BLISTER RUST IN PLANTED NORTHERN WHITE PINE

By RAY R. HIRT[1]

STUDIES were made by Snell (1,2,3) several years ago relative to the development of white pine blister rust and its resulting damage in young stands of *Pinus strobus* within the Adirondacks. So far as the author is aware, however, no such records have been reported for newly established plantations in which the exact date of infection is definitely known. The observations reported in this paper are believed to be of value in connection with the use of northern white pine for reforestation purposes.

In 1927, during the course of some experimental work in blister rust control, a young plantation of northern white pine was established on a sandy flat at the Charles Lathrop Pack Demonstration Forest at Warrensburg, N. Y. The plantation was started with planting stock grown for two years in seed beds and one year in the transplant beds of the New York State Nursery at Saratoga Springs, New York. Planting of the trees extended over 78 days, from July 14 to September 29 inclusive. This was possible because the young pines were potted in paper containers in May, and hence they were not seriously disturbed by handling during the summer season. Each day 20 of the potted pines were placed close to bushes of *Ribes nigrum* L., the leaves of which had the telial stage of *Cronartium ribicola* Fischer well developed. Each set of 20 pines was exposed to inoculation by the rust for 24 hours and then removed to a permanent planting area, where they were spaced 6 x 6 feet. Except for the period of 24 hours in the Ribes garden, the young pines were protected from rust infection by being stored and later planted in an open area surrounded by a Ribes-free border strip 700 feet wide which, on this particular site, gave effective protection against inoculation of the pines by the rust from outside.[2] The total amount of rust infection upon the trees in the plantation in 1927, therefore, is the sum of the daily infections throughout the season, but does not represent the maximum amount that might have resulted from continuous exposure of all the trees to inoculation for the entire period of 78 days.

A total number of 1,560 trees were used, of which 244 (Table 1), or 15.6 per cent, became infected. The infections took place during 57 of the 78 days on which the young pines were exposed to inoculation beneath the *Ribes nigrum* bushes. Of the 244 trees which became infected, 162 trees or 66.4 per cent, became infected during two distinct periods of 3 and 11 days respectively, namely, July 30 to August 1 and August 23 to September 2, inclusive. Upon the infected trees over 900 cankers developed, approximately two-thirds of which appeared on 1926 wood

[1]These investigations were made by the writer while employed as Agent in the Division of Plant Disease Control, Bureau of Entomology and Plant Quarantine, in cooperation with the New York State College of Forestry, Syracuse, N. Y.

[2]During the years from 1928 to 1935 inclusive, one infection from outside occurred upon each of 8 trees in the plantation, as follows: 1 tree, 1928 wood; 2 trees, 1929 wood; 1 tree, 1930 wood; and 4 trees, 1931 wood. Thus there is a possibility that during 1928 some infection may have occurred on 1927 wood and is recorded among the cankers as of 1927 origin. None of the 8 infections listed above are included in this study.

and the remainder on 1927 wood. The diseased trees were examined monthly, beginning in April and continuing through October of each year from 1929 up to and including May, 1935. Data concerning the development of the cankers and the effect of the rust upon the trees were recorded.

Production of Spores

The diameters of the needle-bearing stems and branches in 2-1 stock of northern white pine are very small, so that when the cankers first appeared they were restricted to wood varying in diameter from approximately 0.1 to 0.4 of an inch. These small stems and branches were girdled soon after the fungus extended into the wood, and the portions beyond the cankers died. *Cronartium ribicola* is an obligate parasite, and cannot live or reproduce itself in dead tissue. Hence, though the fungus continually invaded new living tissue, it only occasionally had the opportunity of producing æciospores, because the early death of the newly invaded tissue did not allow sufficient time for these spores to develop. As the trees became older, the diameter of the stems and branches increased, so that by the

Table 1

THE NUMBER AND PERCENTAGE OF INFECTED TREES, ACCORDING TO DAYS, WHICH RESULTED FROM EXPOSING, DAILY, 20 HEALTHY WHITE PINE TREES TO INOCULATION BY CRONARTIUM RIBICOLA FROM JULY 14 TO SEPTEMBER 29, INCLUSIVE, DURING 1927.

	Number and percentage of trees infected[1]					
Day of month	July		August		September	
	Number	Per cent	Number	Per cent	Number	Per cent
1	–	–	9	45	15	75
2	–	–	1	5	6	30
3	–	–	3	15	1	5
4	–	–	0	0	0	0
5	–	–	1	5	1	5
6	–	–	2	10	2	10
7	–	–	4	20	0	0
8	–	–	3	15	1	5
9	–	–	2	10	1	5
10	–	–	1	5	0	0
11	–	–	0	0	0	0
12	–	–	1	5	0	0
13	–	–	2	10	0	0
14	0	0	1	5	0	0
15	0	0	0	0	0	0
16	0	0	3	15	3	15
17	1	5	0	0	1	5
18	2	10	2	10	0	0
19	0	0	1	5	0	0
20	2	10	1	5	1	5
21	0	0	2	10	0	0
22	1	5	3	15	2	10
23	3	15	6	30	1	5
24	4	20	1	5	0	0
25	5	25	8	40	1	5
26	4	20	13	65	2	10
27	3	15	19	95	1	5
28	1	5	17	85	2	10
29	2	10	14	70	1	5
30	10	50	17	85	–	–
31	14	70	13	65	–	–
Total by months	52		150		42	

[1]Total number of infected trees for season, 244.

fall of 1934 the stems near the root crown had reached a maximum diameter of 2.4 inches. In these larger internodes the fungus was able to persist longer, and could develop the æcial stage.

Aeciospores were first produced in 1930 (Table 2), three years after the establishment of the rust. During that year pycniospores were present on more cankers than during any other year. It was expected, therefore, that many cankers would produce æciospores the following spring. In 1931, however, relatively few cankers had æciospores present. The failure of a large number of cankers to produce the æcial stage of the rust in 1931 was due largely to the following causes: (a) many of the infected trees died late in the season of 1930; (b) rodents gnawed the cankers severely during 1930; (c) many of the small infected branches upon which pycniospores were present in 1930 died during the autumn months of that year. From 1930 to 1935, inclusive, æciospores were produced each spring, but only upon relatively few cankers. Cankers on 207 of the trees (84.8+per cent) never produced æciospores.

The greatest number of the cankers with æciospores present during any one year was in 1933, six years after infection occurred. This also represented the highest percentage of cankers which fruited during any one season (Table 2). By 1934 and 1935 many of the infected trees were so severely damaged by the rust as to be killed back to the lowest or next to the lowest whorl of branches. The fungus was thus confined to so limited an amount of living tissue that the amount did not appear to permit the production of æciospores.

One hundred thirteen of the originally infected trees were still alive in the spring of 1935, at which time the rust had completely died on 73 of the trees. These 73 trees which were then free of rust and the 131 infected trees which had died by May, 1935, left only 40 infected trees with the rust still active in them. Four of these trees, or 10 per cent, produced æciospores in 1935. The condition of these remaining 40 infected trees was such that they would be unable to live much longer, and very little opportunity would be afforded the fungus to produce æciospores.

Death of Infected Trees

By May, 1935, 131 of the 244 infected trees were dead (Table 3). Forty-four of these died during 1930. During that

Table 2

PYCNIOSPORE AND ÆCIOSPORE PRODUCTION ON 244 INFECTED TREES FOLLOWING INOCULATION OF 2-1 WHITE PINE STOCK BY CRONARTIUM RIBICOLA IN 1927.

Year	Number of trees producing pycniospores			Number of trees producing æciospores			Number of infected trees alive in May of each year	Percentage of living infected trees with æciospores
	For 1st time	For 2nd time or more	Total	For 1st time	For 2nd time or more	Total		
1928	0	0	0	0	0	0	No record	0
1929	7	0	7	0	0	0	No record	0
1930	44	2	46	3	0	3	239	1.2
1931	7	5	12	12	0	12	195	6.1
1932	5	25	30	5	6	11	189	5.8
1933	3	8	11	12	13	25	163	15.3
1934	4	3	7	4	5	9	143	6.3
1935[1]	0	0	0	1	3	4	113	3.5

[1]The examination was made in May, 1935.

same summer in the region of Warrensburg, N. Y., June beetle larvae, *Phyllophaga* sp., were very abundant and attacked the roots of many kinds of plants. These were a factor in the death of some of the young trees in the plantation. Among the uninfected trees, 112 died during the summer, or 8.86 per cent of those that were alive and uninfected in the fall of 1929. Assuming, then, that 8.86 per cent, or 4 of the 44 infected trees which died in 1930, would have died regardless of the rust infection, *Cronartium ribicola* would have been the main cause of the death of 40 trees that particular year. The total number of uninfected trees which died from sundry causes up to and including May, 1935, was 199 trees, or 15.1 per cent. Reducing the 131 infected trees by 15.1 per cent, there were left 111 trees which it is logical to assume were killed directly by white pine blister rust.

A comparison of the death rates of infected and uninfected pines is shown in Figure 1. It is somewhat lower for both infected and uninfected pines than that found by York, Snell, and Gravatt (4, Fig. 3).

Survival of Infected Trees

It has already been demonstrated that all white pine trees which become infected with *Cronartium ribicola* do not necessarily succumb to the disease (1). This has been pointed out only for older trees; nevertheless, it is also true for trees which become infected at three years of age. Of the 244 trees which had become infected by rust in 1927, 73 were alive

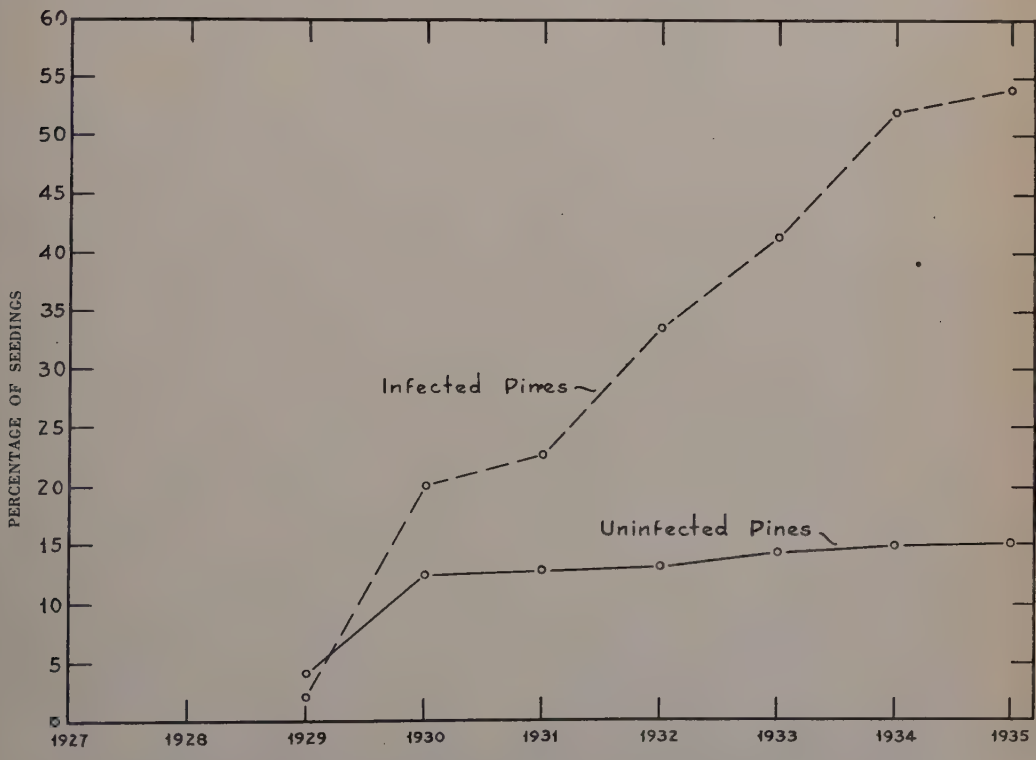


Fig. 1.—Comparative death rates of uninfected pines and pines infected with *Cronartium ribicola* in 1927. The first record was made in 1929.

and free of any symptoms of rust in 1935. The trees had been examined monthly from April to October, inclusive, since the fall of 1928. Most of the 73 trees had shown no symptoms of the rust since 1931. Nineteen of the infected trees became free of rust because rodents gnawed the cankers and so severely injured the bark that the tissues became desiccated and the branches died; consequently the rust was killed. On 47 of the diseased trees the infected branches and stems were killed by the rust and the bark died so far back of the cankers that all of the tissue was killed within which the fungus had been growing. Because of this the fungus was unable to reach new living tissue, and necessarily died. Upon 7 of the trees, the fungus was unable to maintain itself for reasons which could not be determined. It should be emphasized that many of the trees which became free of the rust due to the death of the invaded bark are now badly deformed, and will never produce commercially valuable timber.

Table 3

THE YEARLY RECORD OF THE DEATH OF BOTH INFECTED AND UNINFECTED WHITE PINE TREES IN A PLANTATION ESTABLISHED FROM 2-1 STOCK IN 1927. TWO HUNDRED FORTY-FOUR OF THE 1,560 TREES COMPOSING THE PLANTATION WERE INFECTED WITH CRONARTIUM RIBICOLA

Years	Number of infected trees which died	Number of uninfected trees which died
1928	0	?
1929	5	52[1]
1930	44	112
1931	6	4
1932	26	7
1933	20	14
1934	25	6
1935[2]	5	4
Total	131	199

[1]This is the total number of trees which had died between 1927 and the fall of 1929.

[2]The record extends only through May, 1935.

Conclusions

In a newly established plantation of northern white pine, if perchance some of the trees become infected with white pine blister rust, the percentage of the infected trees which will produce æciospores of the fungus may be rather low. Nevertheless, æciospores will be formed for a number of years following infection, and may intensify the fungus locally if Ribes are present. This emphasizes the need of systematic inspection and reeradication of Ribes in and about a young plantation of northern white pine located within regions of known blister rust infestation.

Some infected trees will survive an attack of blister rust, but this should not encourage any laxity in applying protective measures. Many of these trees become so badly damaged before the fungus dies that they will never develop into trees of commercial value.

Cronartium ribicola may persist for eight years or more in newly established plantations of northern white pine which may become infected with white pine blister rust soon after planting but which are subsequently protected from further invasion by the rust. Each year the ravages of the disease will be evident by the death of some of the infected trees. The owner of such a plantation may account for these results on the basis of new infections, whereas actually the amount of infection is being reduced by the death of the diseased trees. Eventually this process will free the plantation of rust if it is protected from future infections.

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New Forestry Association in Sweden

AT the recent "Forest Week" held in Stockholm a new society was formed on March 14th, known as the "Föreningen för Växtförädling av Skogsträd" or Association for Genetic Improvement of Forest Trees. The purposes of the new society are similar to that of the Institute of Forest Genetics at Placerville, Calif., and to those of various plant breeding stations like the one at Svalöv in Sweden. Officials of the latter station are taking an active interest in the new society. It has long been recognized that silviculture by thinnings, etc., can increase wood production only to a limited degree; selection and breeding of rapidly growing and hardy strains has apparently limitless possibilities, but will require a very long time. Recently several individuals of rapidly-growing poplars were discovered in Central Sweden, and attempts are being made to perpetuate and improve them for match-wood production, much as the N. Y. Botanical Garden and the Oxford Paper Company have done for pulp-growing. It is hoped that a separate institute for tree-breeding may be founded in Sweden.—H. I. Baldwin, *Caroline A. Fox Research and Demonstration Forest.*

EDAPHIC AND VEGETATIONAL CHANGES ASSOCIATED WITH INJURY OF A WHITE PINE PLANTATION BY ROOSTING BIRDS

By VERNON A. YOUNG

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APPARENTLY another enemy of the northern white pine has been added to the already too large list which retards or destroys the growth of this conifer in plantations. The enemy, roosting birds in large invading flocks, may prove to be in many cases more destructive than either fungi or insects. Indeed, a thrifty white pine plantation 15 to 20 years old may be destroyed in one or two years. Moreover the absence of any early signs of injury among the trees from the effect of the bird droppings and foliage disturbances makes the problem even more perplexing than the infestation of either fungi or insects, since one may not suspect such a condition is serious until it is too late. Unless steps are taken in the future to control damage from this source, as first noted by Stewart (5), much capital invested in white pine plantations in the northeastern states may be lost.

History and Purpose of Investigation

The devastating effect of roosting birds on a young northern white pine plantation (two acres) at the New York State College of Forestry Experiment Station located at Syracuse, N. Y., was forcibly brought to the attention of the Director during the winter and spring seasons of 1934-35. Starlings (*Sturmus vulgaris*) were the principal offenders, and the effect of their droppings and mechanical injury to the needles introduced an undesirable environment for the growth of the young white pine. This paper deals with the edaphic and vegetational changes brought about by this new environment.

The plantation, which had received careful silvicultural treatment for 17 years, was first invaded by a small flock of starlings in early September, 1933. These birds roosted in the trees every night until late December, when they left the vicinity. Presumably the same flock returned the following spring, during the latter part of March, and remained until early May. Immediately after their departure a small flock of red-winged blackbirds (*Agelains phoeniceus phoeniceus*) began roosting in the plantation; but they left in late May. During this period as well as the following summer the plantation showed no visible evidence of harmful effects except a few trees, the needles of which revealed a slight yellow tinge; but by late fall some of the trees were apparently dead. In the fall of 1934, a large flock of several thousand starlings spent the usual period from September to December in the plantation. The starlings did not roost in the trees of the first four of five marginal rows (Fig. 1) on this or previous visits. During this period of occupation approximately one-half inch of droppings was deposited on the plantation floor, and considerable defoliation resulted from the activities of the roosting birds on the branches of the trees. Neither the starling nor the blackbird flocks returned the following spring or fall seasons of 1935, which may have been due to the lack of protection offered by the defoliated trees.

As the winter season of 1934-35 waned, it became evident that a large percentage of the trees where the starlings roosted were injured, because many had dropped a large percentage of their needles while

the leaves of others affected were yellow to brownish. By midsummer a high mortality had occurred, as shown by Fig. 1, and only a sprinkling of live trees remained by late fall. The plantation floor during this time became covered with a dense growth of herbaceous and woody species (Fig. 2), which had grown, in most cases, from seeds introduced in the droppings of the birds. These droppings rapidly decomposed, and leached into the inorganic substratum with the advance of the summer season, one of unusually high precipitation for central New York.

Methods

Not until the middle of July was the vegetation of the ground cover sufficiently developed for reliable identification. At this time both soil and plant studies were begun. Soil samples were taken among the roots of the trees to a depth of two feet in six representative areas of the plantation, as well as two places in a small adjoining (uninjured) white pine plantation of the same age as the injured one. The divisions of each soil profile sampled are listed in Table 1. Soil samples were taken again in the same general areas on September 28, in order to determine the amount of nitrates lost either by leaching or assimilation by the dense growth of the forest floor vegetation during the intervening approximately sixty days, in which considerable rain fell. All soil samples were permitted to reach constant air dryness before analytical determinations were made. Analytical determinations were made for hydrogen-ion concentration, phosphorus, potassium, and nitrogen compounds. The determination of the nitrogen compounds included Kjeldahl nitrogen and nitrates. The hydrogen-ion concentration was determined by the quinhydrone method. The phosphorus and potassium determinations were made according to methods outlined by the Association of Official Agricultural Chemists (1, pp 10-11). Kjeldahl nitrogen determinations were secured by the Gunning-Hibbard method (1, pp 1-3), while the principal method employed for nitrate analyses is the one employed by Feustel and Byers (3, pp 4-7). In many cases the nitrate values were checked by the phenoldisulphonic method.[1] It has been the experience of the writer in the past that accurate nitrate data are difficult to obtain in forest soils because of certain organic as well as inorganic constituents which influence the reactions. The results of the nitrate determinations are listed in Table 1.

Plant studies were based primarily upon belt transect and quadrat measurements in areas supporting representative vegetation of the plantations, in order to determine both the identification of species and their abundance. Because of the dense and tangled growth of the plants it was necessary for count and identification purposes to remove each individual from the soil in the belt transects. In some instances one-meter quadrat studies were made without resorting to the transect treatment of removing the plants. Eight one-meter quadrats were selected to compare the degree of mortality which might occur because of competition during the rapid-growing period from July 15 to late September. In quadrats 1, 2, and 3 all species and their abundance were determined except for buckthorn (*Rhamnus cathartica*). This species was so abundant that a reliable count could not be made without removing all of the other plants. All herbaceous plants were removed from quadrats 4 and 5, and, with the exception of buckthorn, the woody species and their abundance were recorded, while in quad-

[1]The writer is indebted to Dr. E. V. Staker, Soil Technician at Cornell University, Ithaca, N. Y., for the check determinations.

rats 6, 7, and 8 all plants were removed except *Rhamnus cathartica.*

As the plant studies progressed during the summer, it became evident that certain species not sufficiently abundant to occur in either the transect or quadrat units were to be found in the plantation, and as these plants developed they were carefully sought out and identified.

All data dealing with the plant studies in the transect and quadrat units are listed in Tables 2, 3, 4, and 5.

Results

Three notable things happened: soil characteristics changed; new vegetation was introduced; and the pines overhead were killed.

Soil Data.—The analytical and electrometric results obtained from the soil studies of both injured and uninjured plantations are listed in Table 1. A comparison of these results definitely shows that the bird droppings deposited in the injured plantations added large quantities of nitrogen compounds as well as considerable amounts of phosphorus and potassium to the upper 12 inches of the soil.

Considering the nitrogen compounds for both the total nitrogen (Kjeldahl analyses) and nitrates, they are considerably higher in the upper 24 inches of the soil of the injured plantation than in those of the uninjured plantation. These values also show a gradient decrease with depth in the soils of both plantations; strikingly so in the injured plantation. A comparison of the nitrate results in relation to depth in the injured and uninjured plantations shows that the values of the humus layer of the former during July are 268 parts per million (ppm) and approximately four times as great as those (69 ppm) for the latter. This ratio also holds true for the nitrate values of the first (194 ppm), second (181 ppm), and third (182 ppm) inches of the soil in the injured plantation, as compared with the nitrate values of the same soil units (54 ppm, 54 ppm, and 46 ppm) of the uninjured plantation. The nitrates in soil unit 12-24 inches are very high (72 ppm) in the injured plantation, as compared with those (36 ppm) of the uninjured plantation.

Nitrates were unquestionably more concentrated in the first 6 inches of the soil in the injured plantation in the early spring than in July, when the above analyses were made. During early April the odor of escaping free ammonia could be easily detected.

It is interesting to note that a significant reduction in the nitrate values occurred in the soil units of the injured plantation soil between July 15 and September 28. During this period approximately two-thirds of the nitrates disappeared from the injured plantation soil, either by leaching or assimilation by the abundant growth of the plant invaders. The soil of the uninjured plantation lost only a medium amount of nitrates in the upper 3 inches of soil, and practically none in the units below this level in the profiles. Soil temperature may account for the small differences in the nitrate values of July and September, since conditions are more favorable for nitrate development in summer than in the fall.

The phosphorus results of Table 1 show that the first inch of soil in the injured plantation contains 2,380 ppm as compared with 2,020 ppm in the same level of the uninjured stand, but in the third inch of soil of the former there are 2,280 ppm as compared with 1,670 ppm at the same depth in the soil of the latter. In soil unit 3-6 inches in the injured stand there are 2,290 ppm of phosphorus as compared with 1,810 ppm in the same level of the uninjured plantation, while in soil unit 6-12 inches of the former occur 2,400 ppm as compared with 1,200 ppm in the same unit of the latter stand.

According to the potassium values in Table 1, the upper 6 inches of soil in the injured plantation are remarkably higher than those of the uninjured plantation. The first inch of the injured plantation soil shows 29,400 ppm as compared with 25,600 ppm in the uninjured plantation, but in the third inch of soil of the former there are 19,400 ppm as compared to 17,100 ppm in the same soil level of the latter. There are 25,600 ppm of potassium in the soil unit 3-6 inches in the injured stand, as compared with 20,500 ppm of the same layer in the uninjured stand. In soil unit 6-12 inches in both plantations the potassium values are essentially identical, since the injured plantation shows 16,800 ppm and the uninjured 16,700.

An examination of the hydrogen-ion results of Table 1 shows that the pH values of the soil units in the upper foot of the injured plantation substratum are slightly smaller than those of the uninjured plantation soil units. Such a condition would be expected, since the abundance of nitrates found in the soil of the injured plantation would increase the acidity. The basic value (pH 7.3) of soil unit 12-24 inches bespeaks the calcareous composition of the heavy gravel substratum supporting the trees of both plantations. (The general area lies in the Onondaga Valley, formed by glacial action at the base of the eastern footslope (Fig. 1), rich in limestone outcroppings.) The upper three or four inches of mineral soil is a medium loam, which is no doubt a product of erosion deposition and organic decomposition. Below this level, as far as sampled, occurs a fine to coarse gravel substratum, extremely compact; and when the moisture content is low it behaves similarly to a hard pan. It would seem logical to conclude, however, that the hydrogen-ion concentration plays little or no role in the injury of the white pine, since the difference between the value of the soils on both plantations is very small.

Summarizing the nitrate, phosporus, and potassium data of Table 1 in relation to what their apparent effect was on the growth of the young white pine trees, it would seem logical to conclude that the additional amounts deposited by the starlings brought a very harmful result. Since these elements soon became available for plant use after decomposition, the young trees apparently assimilated such large amounts that the physiological reaction became extremely unfavorable for growth, and death resulted in a very short time.

An interesting test of the theory that the normal physiological composition of the white pine trees was upset by the abundance of the above elements was made by Prof. A. H. MacAndrews, acting head of the Entomology Department, who

TABLE 1

COMPARISONS OF THE SOIL AT THE ROOTS OF WHITE PINE FOR BOTH INJURED AND UNINJURED PLANTATIONS, SHOWING INDIVIDUAL VALUES AT VARIOUS DEPTHS

	Injured plantation						Uninjured plantation					
		July 14				Oct. 1		July 14				Oct. 1
Depth	pH	Kjel. nitro. ppm	Nitrate ppm	Phosphorus ppm	Potassium ppm	Nitrate ppm	pH	Kjel. nitro. ppm	Nitrate ppm	Phosphorus ppm	Potassium ppm	Nitrate ppm
Humus[1]	5.0	420	268			86	5.7	168	69			46
1″	5.2	280	194	2380	29400	67	5.5	140	54	2020	25600	42
2″	5.2	252	181			54	5.4	140	54			40
3″	5.5	266	182	2280	19400	55	6.1	128	46	1670	17100	42
3-6″	5.9	154	106	2290	25600	40	6.1	140	41	1810	20500	39
6-12″	6.4	140	70	2400	16800	42	6.7	126	40	1200	16700	37
12-24″	7.3	154	72			26	7.2	98	36			41

[1]The humus unit reacted so unfavorably to phosphorus and potassium analyses that reliable data could not be obtained.

conducted the following experiment. He placed dying branches of the injured white pine trees in cages under laboratory environment, with two species of bark beetles, *Ips pini* and *Pityogenes hopkinsi*. These beetles refused to attack the injured branches, and many of the beetles died before they were removed to cages containing the branches of uninjured trees, where a perfect attack occurred. According to the observations of entomologists, certain species among these genera will in general freely attack unhealthy pine trees, but occasionally the cells of certain trees are so unbalanced physiologically that it is believed they become toxic to the insects. This would seem to be true in this experiment.

The evidence strongly indicates that the white pine trees suffered severely from an oversupply of mineral nutrients in the soil. Nevertheless, the mechanical injury to the leaves by the roosting starlings was also an important factor. It was not uncommon during the fall roosting period of 1934 to find many fascicles of leaves on the ground, apparently in consequence of mechanical injury caused by the activities of the starlings on the branches of the trees.

In conclusion, the evidence would indicate that both the mineral elements added to the soil by the bird droppings and the mechanical injury to the leaves introduced conditions unfavorable to the normal growth of the white pine trees; and as a result, partial injury or death followed very quickly.

Plant Data.—The data of the plant studies listed in Tables 2 and 2a indicate that the roosting birds introduced by means of their droppings a large number of plant species into the injured plantation, and several of these grew in great

Fig. 1.—An aerial view of a portion of the New York State College of Forestry Experiment Station, showing injured and uninjured white pine plantations. Note the border of uninjured trees after the removal of all dead individuals. The limestone footslope to the east supports a native forest. Photograph by Roy Sydansk.

abundance. After a review of these data the two following questions may arise: first, how can one be assured that these species were so introduced; secondly, is it possible for the seed of 72 species to pass through the digestive tracts of the roosting birds and still be viable?

The first question can be answered by comparing the forest floor vegetation of the uninjured plantation (Fig. 2) with that of the injured one (Fig. 3), since both received identical silvicultural treatment until the spring of 1935 (all invading species were removed annually). An examination of the stomach contents of a representative number of the roosting birds common to the plantation during the fall of 1934 would, no doubt, have solved the second question, since the seeds used for their food should have been highly representative of the floor vegetation of 1935. Since study of the problem was not begun until the summer of 1935, and the starlings did not return, this evidence did not become available. Comparisons were made, however, from data obtained by Kalmbach and Gabrielson (4, pp 15-66), who examined the stomachs of 1,275 adult starlings as to their food requirements. These biologists showed that 43 per cent of the starlings' food was vegetable and 57 per cent was animal. In addition, they reported that the principal food of the starlings, beginning with September until the next spring, was seeds with hard coats whose germinating qualities were uninjured after passing through the digestive tract. It is interesting to note that the plants listed in the transect and quadrat units of Tables 2 and 2a almost parallel those reported by Kalmbach and Gabrielson.

Fig. 2.—Uninjured plantation, showing normal trees 20 years old as well as the clean forest floor.

The data of the plant studies show clearly that *Rhamnus cathartica* is eaten in large quantities by the starlings, since it furnished 83 per cent of their food as based on the total plant population of the quadrat units. Other species listed in Tables 2 and 2a which ranked high in order of their abundance of total plant population in terms of percentage are: black cherry, 23.5; elderberry, 21.1; nightshade, 17.9; white mulberry, 8.4; red raspberry, 5.6; choke cherry, 4.0; staghorn sumac, 2.1; pin cherry, 2.1; dogwood, 1.4; and ragweed (*A. artemisaefolia*), 1.1. Many others, which formed a smaller percentage of the general diet of the roosting birds, are listed in a gradient order. The data of Tables 2 and 2a also show that the starlings eat the seeds of more herbaceous than woody species, but the latter furnished the higher percentage of their food. A few of the species listed in the above tables were no doubt introduced by agents of distribution other than birds. Sugar maple seeds, for illustration, were carried in great abundance by the wind into the plantation from a row of large maple trees growing only a few feet from its margin.

Wind was also the disseminating agent for English maple seeds as well as for

American elm. The presence of dandelion, goldenrod, aster, and wild lettuce plants may in part be attributed to the wind, although seeds of these species are eaten by starlings. Birds other than starlings may have introduced in a minor degree certain species, such as cultivated cherry, the seeds of which are widely distributed by robins. The abundance of poison ivy in the plantation points out how readily the seeds of this undesirable plant are distributed by birds. The presence of *Ribes* in the white pine stand also strongly emphasizes the difficulty of eradicating this genus as a control method in white pine blister rust attack when birds are carriers of the seeds.

The role played by the blackbirds in seed distribution was apparently negligible because their food, according to Beal (2, pp 33-43) is composed of 31.8 per cent animal matter and 62 per cent vegetable matter; and of the latter, 60 per cent is cultivated grains. Only a single rye plant represented the grain population identified in the plantation which would indicate that blackbirds might have roosted in the white pine plantation.

The soil of the injured plantation, supplied with an abundance of nitrates, stimulated the luxuriant growth of the plants introduced by the roosting birds. Elderberry in many instances attained a height of 12 feet approximately six months after seed germination, and in one case a plant grew to a height of 14 feet. Slender stem growth associated with large leaves were the usual types of foliage developed among the herbaceous species. Because of the unusually dense growth of the introduced species, a most severe type of competition became effective with the advance of the growing season. Quadrat studies, mentioned above, were made to determine the effect of competition among the various species. The results are listed in Table 3.

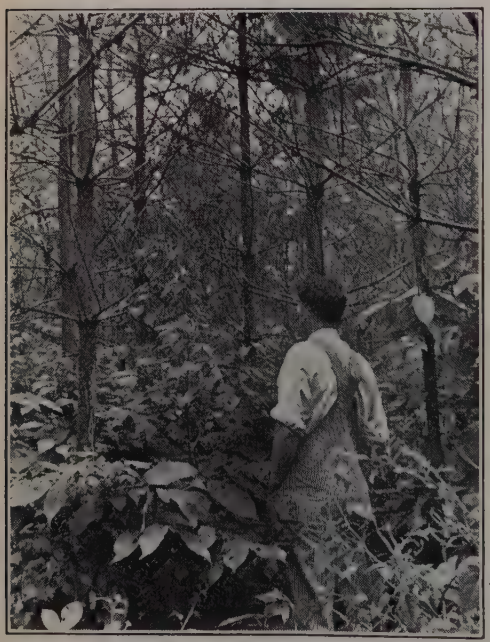

Fig. 3.—Plantation injured by roosting starlings, showing the dense growth of vegetation in September which developed from the seeds introduced in the bird droppings.

Fig. 4.—Injured plantation, showing the forest floor vegetation growth August 1. Note the few leaves on the dying trees.

The data in Table 3 definitely show at the woody species suffered a considerably higher mortality than the herbaceous plants. This was due primarily to the dense shade supplied by the more rapid-growing herbaceous species. These species in several cases lodged because of the tremendous bulk and weight of the large leaves on slender stems. The seedlings of four shrubs, buckthorn, Virginia creeper, raspberry, and dogwood, in quadrats 1, 2, and 3 suffered almost complete destruction, while black cherry showed the highest mortality (78.7 per cent) among the tree seedlings. All of the *Prunus* species showed a high degree of intolerance in competition with the herbaceous species. Elderberry revealed a high mortality (66.7 per cent), but many of the survivors made extremely rapid and large growth. Sugar maple suffered the lowest mortality (14.1 per cent) of all the woody species.

The herbaceous species varied widely as to their ability to withstand competition (Table 3). Since these species grew more rapidly than the woody plants, they showed a lower percentage of mortality.

A comparison of data in Table 4 for quadrats 4 and 5 shows that with the exception of *Rhus hirta* the woody species suffer a low mortality when the herbaceous species are removed. White mulberry and black cherry made taller growths than the other tree species in these quadrats, the former in some cases attaining a height of 4 feet and the latter 3 feet.

According to the data of Table 5, buckthorn showed an average mortality of only 7 per cent in quadrats 6, 7, and 8, where it grew as a single species, notwithstanding the fact that 1,197 plants comprised the mean population. It will be recalled that this shrub, when growing in competition with all the species of quadrat units 1, 2, and 3, suffered almost completely destruction. These data point out in a most pronounced manner the effect of dense shade upon buckthorn in the mixed forest floor vegetation.

Summary and Conclusions

Starlings roosting in a small white pine plantation during the fall seasons of 1933 and 1934 introduced an undesirable environment for the growth of the trees. These birds mechanically injured the leaves during their roosting activities and deposited large amounts of undesirable droppings on the plantation floor.

Soil analyses of the injured and uninjured plantations show that the nitrate, phosphorus, and potassium values are considerably higher in the former than in the latter. These nutrient elements soon became available for assimilation by the trees, which apparently upset their physiological reaction; and death resulted in a short time.

Two beetles, *Ips pini* and *Pityogenes hopkinsi*, which normally attack unhealthy pine trees, would not attack the branches of the injured trees, but readily attacked those of the uninjured trees.

Among the 72 species of plants growing in the injured plantation, 68 germinated from seeds with hard coats introduced in the droppings of the roosting birds.

Buckthorn, black cherry, elderberry, and nightshade seeds formed the principal diet of the starlings from September to late December.

Viable seeds of *Ribes* were introduced in the droppings of the starlings; this creates a serious problem in the eradication of this genus in white pine plantations as a control method in attacks of *Cronartium ribicola.*

A most severe type of competition occurred among the plant species of the plantation floor. The woody plants suffered a higher mortality than the herbaceous forms, since they grew slower and came under the influence of dense shade. Buckthorn, Virginia creeper, raspberry,

and dogwood were extremely intolerant in the mixed vegetation.

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Table 2

HERBACEOUS SPECIES AND THEIR ABUNDANCE IN BELT TRANSECT 2 FEET WIDE AND 42 FEET LONG IN THE INJURED WHITE PINE PLANTATION

	Herbaceous species		No. of Plants	Percentage of herbaceous species	Percentage of total woody and herbaceous species
1	Nightshade	*Solanum dulcamara*	543	68.2	17.9
2	Smartweed	*Polygonum persicaria*	77	9.7	2.5
3	Ragweed	*Ambrosia artemisiaefolia*	34	4.3	1.1
4	Pokeberry	*Phytolacca decandra*	22	2.8	0.7
5	Lambs quarters	*Chenopodium album*	14	1.8	0.5
6	Swamp smartweed	*Polygonum pennsylvanicum*	13	1.7	0.4
7	Black bindweed	*Solanum convolvulus*	12	1.6	0.4
8	Asparagus	*Asparagus officinalis*	9	1.1	0.3
9	Dandelion	*Taraxacum officinale*	8	1.0	0.3
10	Yellow foxtail	*Setaria lutescens*	8	1.0	0.3
11	White mustard	*Brassica alba*	5	0.6	0.2
12	Aster	*Aster paniculatus*	4	0.5	0.1
13	Catnip	*Nepeta cataria*	4	0.5	0.1
14	Beggar-ticks	*Bidens frondosa*	3	0.4	0.09
15	Cheeses	*Malva rotundifolia*	3	0.4	0.09
16	Cultivated buckwheat	*Fagopyrum esculentum*	3	0.4	0.09
17	White campion	*Lychnis alba*	3	0.4	0.09
18	Wild lettuce	*Lactuca virosa*	3	0.4	0.09
19	Lady's sorrel	*Oxalis stricta*	3	0.4	0.09
20	Three-seeded mercury	*Acalypha virginica*	3	0.4	0.09
21	Giant ragweed	*Ambrosia trifida*	2	0.25	0.07
22	Wild strawberry	*Fragaria virginiana*	2	0.25	0.07
23	Bedstraw	*Galium mollugo*	2	0.25	0.07
24	Myrtle-leaved pea	*Lathyrus myrtifolius*	2	0.25	0.07
25	Puccoon	*Lithospermum officinale*	2	0.25	0.07
26	Mint	*Mentha canadensis*	2	0.25	0.07
27	Buttercup	*Ranunculus acris*	2	0.25	0.07
28	Sow thistle	*Sonchus oleraceus*	2	0.25	0.07
29	Wild carrot	*Daucus carota*	1	0.1	0.03
30	Orchard grass	*Dactylis glomerata*	1	0.1	0.03
31	Cultivated rye	*Elymus (?)*	1	0.1	0.03
32	Herb robert	*Geranium robertianum*	1	0.1	0.03
33	Wild lettuce	*Lactuca hirsuta*	1	0.1	0.03
34	Pepperwort	*Lepidium campestre*	1	0.1	0.03
35	Black medick	*Medicago lupulina*		0.1	0.03
			796		

Herbaceous species in the injured plantation but not occurring in belt transect or quadrat units were:

Wild aster	*Aster prenanthoides*
Swamp thistle	*Cirsium muticum*
Wild carrot	*Daucus carota*
Fleabane daisy	*Erigeron philadelphicus*
Avens	*Geum canadense*
Morning glory	*Ipomoea hederacea*
Cultivated tomato	*Lycopersicon esculentum*
Evening primrose	*Oenothera biennis*
Ground cherry	*Physalis subglabrata*
Broad-leaf plantain	*Plantago major*
Curly dock	*Rumex crispus*
Catchfly	*Silene latifolia*
Goldenrod	*Solidago altissima*
Red clover	*Trifolium pratense*

TABLE 2A

WOODY SPECIES AND THEIR ABUNDANCE IN BELT TRANSECT 2 FEET WIDE BY 42 FEET LONG IN THE INJURED WHITE PINE PLANTATION

Wood species		No. of plants	Percentage of woody species	Percentage of total woody and herbaceous species
Buckthorn	*Rhamnus cathartica*	Numerous	Numerous	—
Black cherry	*Prunus serotina*	710	31.8	23.5
Elderberry	*Sambucus canadensis*	637	28.6	21.1
White mulberry	*Morus alba*	253	11.3	8.4
Raspberry	*Rubus idaeus*	168	7.5	5.6
Choke cherry	*Prunus virginiana*	122	5.5	4.0
Sugar maple	*Acer saccharum*	105	4.7	3.5
Staghorn sumach	*Rhus hirta*	63	2.9	2.1
Pin cherry	*Prunus pennsylvanica*	62	2.8	2.1
Dogwood	*Cornus paniculata*	42	1.4	1.4
Poison ivy	*Rhus toxicodendron*	25	1.1	0.8
Sorbaria	*Sorbaria sorbifolia*	16	0.7	0.5
Cultivated cherry[1]	*Prunus avium*	9	0.5	0.3
Virginia creeper	*Psedera quinquefolia*	8	0.4	0.3
English maple	*Acer campestre*	6	0.3	0.2
Honeysuckle	*Lonicera tatarica*	4	0.2	0.1
Gooseberry	*Ribes rotundifolium*	2	0.09	.06
Wild rose	*Rosa virginiana*	1	0.04	.03
	Total plants	2233		

[1]Much difficulty was experienced in the identification of the *Prunus* species because of the ect of the dense shade and other competition factors on their morphological development.

Woody species in the injured plantation but not occurring in the belt transect r quadrats were:

Tulip poplar	*Liriodendron tulipifera*
Black mulberry	*Morus nigra*
Black locust	*Robinia pseudacacia*
American elm	*Ulmus americana*
Wild grape	*Vitis aestivalis*

TABLE 3

MORTALITY OF PLANTS IN METER QUADRATS 1, 2, AND 3 DUE TO COMPETITION AMONG THE SPECIES FROM JULY TO SEPTEMBER

Species	Quadrat 1 July 14	Quadrat 1 Sept. 14	Quadrat 1 Percentage of mortality	Quadrat 2 July 15	Quadrat 2 Sept. 15	Quadrat 2 Percentage of mortality	Quadrat 3 July 16	Quadrat 3 Sept. 16	Quadrat 3 Percentage of mortality
Solanum dulcamara	50	16	68.0	41	27	34.2	61	23	62.4
Sambucus canadensis	34	6	82.5	22	12	45.5	18	5	72.3
Prunus serotina	31	4	93.7	39	12	69.3	26	7	73.1
Acer saccharum	20	14	30.0	8	8	—	16	14	12.5
Rhus toxicodendron	14	5	64.2	21	6	71.5	4	4	—
Prunus virginiana	12	5	58.3	16	4	75.0	9	0	100.0
Morus alba	12	7	41.6	5	—	20.0	7	6	14.3
Prunus pennsylvanica	9	2	77.8	6	1	83.5	12	4	66.6
Cornus paniculata	3	0	100.0	8	1	87.5	1	0	100.0
Rubus idaeus	6	1	83.5	2	0	100.0	3	2	33.3
Polygonum persicaria	6	6	100.0	4	3	25.0	7	3	37.2
Phytolacca decandra	4	2	50.0	1	1	—	3	2	33.3
Rhus hirta	3	1	66.6	0	0	—	0	0	
Chenopodium album	3	3	100.0	2	2	—	2	1	50.0
Sorbaria sorbifolia	2	1	50.0	1	1	—	0	0	—
Polygonum pennsylvanicum	2	2	—	8	5	37.6	2	2	—
Oxalis stricta	2	2	—	0	0	—	1	1	—
Lactuca virosa	2	0	100.0	1	1	—	0	0	—
Psedera quinquefolia	2	—	100.0	0	0	—	1	0	100.0
Ambrosia artemisiifolia	2	2	—	3	3	—	3	2	33.3
Setaria lutescens	2	2	—	2	2	—	0	0	—
Acer campestre	1	1	—	0	0	—	0	0	—
Brassica alba	1	1	—	0	0	—	0	0	—
Dactylis glomerata	1	1	—	3	3	—	0	0	—
Fragaria virginiana	1	0	100.0	0	0	—	0	0	—
Galium mollugo	1	1	—	0	0	—	2	2	—
Lithospermum officinale	1	1	—	0	0	—	0	0	—
Nepeta cataria	1	1	—	2	1	50.0	0	0	—
Ranunculus acris	1	1	—	0	0	—	0	0	—
Solanum convolvulus	1	1	—	0	0	—	0	0	—
Asparagus officinalis	0	0	—	2	1	50.0	0	0	—
Bidens frondosa	0	0	—	1	1	—	1	1	—
Lonicera tatarica	0	0	—	1	1	—	0	0	—
Sonchus oleraceus	0	0	—	2	1	50.0	0	0	—
Taraxacum officinale	0	0	—	1	1	—	0	0	—
Rhamnus cathartica	?	9	—	?	17	—	?	6	—
Totals	230	98	—	202	115	—	179	85	

TABLE 4

THE NUMBER OF WOODY SPECIES IN JULY AND SEPTEMBER IN METER QUADRATS 4 AND 5, AND THE PERCENTAGE OF MORTALITY WHEN HERBACEOUS PLANTS WERE REMOVED

Species[1]	Quadrat 4			Quadrat 5		
	July	Sept.	Percentage of mortality	July	Sept.	Percentage of mortality
Prunus serotina	48	39	18.8	57	42	26.3
Rhus toxicodendron	19	12	36.8	12	10	16.7
Acer saccharum	19	18	5.3	26	26	0.0
Prunus pennsylvanica	14	10	28.6	8	7	12.5
Prunus virginiana	10	10	0.0	16	9	43.8
Morus alba	7	7	0.0	9	9	0.0
Rubus idaeus	7	3	57.1	10	4	60.0
Cornus paniculata	4	2	50.0	1	1	0.0
Sorbaria sorbifolia	3	3	0.0	0	0	0.0
Prunus avium	2	2	0.0	6	6	0.0
Rhus hirta	2	0	100.0	1	1	0.0
Ribes rotundifolium	0	0	0.0	1	1	0.0
Total	135	106		147	116	

[1]It was necessary to remove the *Sambucus* plants because a few grew so fast they completely shaded other species.

TABLE 5

THE NUMBER OF BUCKTHORN PLANTS IN JULY AND SEPTEMBER IN METER QUADRATS 6, 7, AND 8, AND THE PERCENTAGE OF MORTALITY WHEN ALL OTHER PLANTS WERE REMOVED

Species	Quadrat 6			Quadrat 7			Quadrat 8		
	July	Sept.	Percentage of mortality	July	Sept.	Percentage of mortality	July	Sept.	Percentage of mortality
Rhamnus cathartica	1054	918	12.9	1328	1161	12.6	1210	962	20.5

BACKFIRING TO CONTROL CHAPARRAL FIRES

By SPENCE D. TURNER[1]

Department of Forestry, County of Los Angeles, California

On October 23, 1935, in Los Angeles County, Calif., four major forest conflagrations broke out within a period of ten hours. Two of these fires, which eventually tied in and became one fire, burned nearly 30,000 acres and caused an estimated property damage to watersheds and buildings in excess of $2,500,000. This article demonstrates how backfiring combined with the use of tank truck apparatus was used to bring under control one of these fires, that known as the Latigo Canyon fire.

EARLY on the morning of October 23, 1935, a fire known as the Malibu fire broke out in the Santa Monica Mountains, Calif. Despite extremely adverse weather conditions of low humidity, high temperatures, and a wind velocity that reached 50 miles an hour, the fire was brought partially under control that night, and by the morning of the 24th its perimeter was under control and only the eastern and northeastern lines were in danger.

Added equipment and personnel were released from the 2,100-acre Las Flores fire near Altadena and sent to the Malibu fire. These were augmented by personnel and equipment from the various C.C.C. camps throughout the southern part of the state, together with overhead supplies by the U. S. Forest Service and the state Division of Forestry. Late in the afternoon of October 24, backfiring was resorted to from a motorway to save the Malibu C.C.C. camp. During the evening of this day backfiring was also started from the ocean up the west side of Malibu Creek to the Malibu Dam. This last action was necessary to prevent the fire from crossing the Malibu Creek and running easterly into the heavily populated Las Flores and Topanga Canyon territories.

On October 25 weather conditions were still adverse, with low humidity, high temperature, and northerly winds. Conditions generally on the fire line, however, were much improved. There remained only three active sectors. At daylight an intensive drive was started along the Latigo Canyon road, by a combination of backfire and water application, and the control measures were almost effective. But in the afternoon increase of wind spotted fire across this line over the fire fighters, and at the same time took the fire over the firebreak near Mesa Peak and established it on the easterly side of the main range. Also, the line at the upper end of Malibu Creek flared up and threatened to cross the creek above the dam.

New strategy was immediately adopted. Malibu Creek from the dam to a continuation of the Mesa Peak firebreak was backfired, and the break-over controlled; and backfiring operations from Mesa Peak westerly toward Castro Peak were commenced.

Backfiring work done in the Malibu Creek above the dam was materially aided by the use of nine portable pumps. The floor of this canyon is extremely narrow, and both it and its adjacent sides are heavily covered with broadleaf trees and shrubs. Without the use of water, the outcome would have been dubious.

One emergency firebreak was constructed from the Latigo Canyon road to Castro Peak, and the orders were to backfire easterly from this break and along

[1]Forester and Fire Warden for Los Angeles County, California.

the west side of the combination Castro Peak firebreak and motorway, and to "tie in" with the backfiring party working west from Mesa Peak. Backfire efforts were immediately successful on the easterly end of the area, around Malibu Creek and Mesa Peak, but adverse winds made it impossible to backfire from the Castro Peak sector until 3 o'clock of the afternoon of October 26. The delay did not jeopardize control of the approaching main fire, which was making rather indifferent progress over a very rugged terrain in this area.

Throughout the night of the 25th and all day of the 26th the emergency firebreak was widened, and possibly the most elaborate lay-out of fire hose ever made on a mountainous fire in southern California was completed to assist in the backfire work. Castro Peak lookout tower is provided for fire protection with a 5,000-gallon steel storage water tank. Seven units of tank truck fire apparatus were taken to the top of the mountain. This fleet was comprised of five 600-gallon, one 450-gallon, and one 250-gallon tanks, or an aggregate capacity of 3,700 gallons, which with the 5,000 gallons of water in the storage tank gave an initial supply of 8,700 gallons.

The emergency firebreak ran down the south slope of Castro Peak, starting from an elevation of 2,770 feet and dropping to an elevation of 2,280 feet in the first 2,000 feet, then rising in the next 600 feet to an elevation of 2,380 feet. Twenty-six hundred feet of 1½-inch double-jacket rubber-lined hose were laid from the first pumper at the top of the mountain to the 2,380-foot elevation. At each 400-foot interval in this line two 150-foot 1-inch single-jacket rubber-lined lines were siamesed. Valves were so placed that in the event of a break in the line as much water as possible could be saved.

A total of over 4,100 feet of hose was laid out, and the pressure at the lowest point was 212.7 pounds. From the pumper located at the 2,770-foot point, lines were laid to a pumper adjacent to the 5,000-gallon storage tank for relay purposes. Three of the 600-gallon tank trucks were then assigned to refill the 5,000-gallon storage tank. This necessitated a drive of approximately two miles down the mountain. Some 13,500 gallons of water were used in controlling the backfire job along this "hose lay."

On several occasions, particularly when the main fire made runs and met the backfire close to the firebreaks, a strenuous fight was necessary to keep the flames from crossing the emergency firebreak. Without the use of water lines it is doubtful whether the backfire work would have been successful. Backfiring was first started from the lower end of the hose lay, or at the 2,380-foot elevation point. From this point to the Latigo Canyon road, a distance of 2,500 feet, backfiring had been accomplished the previous night because topography and available water enabled us to do so with safety. Backfiring then proceeded down into the saddle; and once this saddle was reached, backfiring was started on the top of the main ridge at the 2,770-foot point. Simultaneously with this, backfiring was also started east along the main ridge; and by noon of the 27th this backfire crew tied in with the backfiring being done west of Mesa Peak. On this long run only one break-over occurred, which was quickly controlled by the use of water lines, tank trucks keeping pace with the backfiring crews.

Although backfires to the layman are the desirable thing, it is this Department's practice never to use a backfire unless absolutely essential. This fire, however, was practically controlled by the use of backfires. The total mileage of backfiring from the ocean at Malibu Creek and along the main ridge between Mesa and Castro Peaks, then down into Dume Canyon, a

few miles above the ocean, to the west of Malibu Creek, was 16.7 miles. That firebreaks and motorways are essential in backfiring measures is proved by Table 1.

TABLE 1

MILES OF BACKFIRE USED TO CONTROL MALIBU FIRE

	Miles
Existing firebreaks backfired	5.4
Firebreaks constructed during fire and backfired	2.6
Motorways backfired	4.7
Creek bottoms and other lines backfired	4.
Total	16.7

With the completion of the backfiring, the fire was brought under control. Because the weather was still adverse throughout the locality, equipment and personnel were dispatched to their respective stations as speedily as possible. The acreage involved in this fire, not including the Sherwood Lake fire, which eventually tied in to it, was 15,296 acres.

The approximate number of pumpers, equipment, and man-power used is shown in Table 2.

TABLE 2

AMOUNT OF EQUIPMENT AND PERSONNEL USED TO CONTROL THE MALIBU FIRE

Department of County Forester and Fire Warden
Field divisions:
- 2 250-gallon tank truck apparatus
- 1 500-gallon tank truck apparatus
- 6 600-gallon tank truck apparatus
- 1 50-gallon Ford patrol car
- 9 portable pumps
- 158 men

County fire protection districts:
- 1 750-gallon engine
- 11 men

City of Beverly Hills:
- 1 tank truck and crew (no pump)

Forest Service:
- 2 450-gallon tank truck apparatus
- Man-power: tank crews and overhead

State Division of Forestry:
- 6 overhead men

Malibu Beach Colony:
- 1 300-gallon engine and engineer.

Approximately 2,000 fire fighters were on the fire at one time. They were drawn from this Department's three S.E.R.A. camps for transients and two C.C.C. camps, and from 32 other C.C.C. and S.C.S. camps located throughout the southern part of the state.

BRIEFER ARTICLES AND NOTES

Lumber Industry Urged to Continue Conservation Set-Up

The following letter from the Chief of the Forest Service to Captain Woods is, in effect, an open letter to the lumber industry, written for presentation at the National Lumber Manufacturers' Association meeting in Chicago, April 23-25.

April 21, 1936.

Captain John B. Woods,
National Lumber Manufacturers'
Association.

Dear Captain Woods:

Indications are many that we are definitely emerging from the worst depression this country has ever had. One of the most encouraging things is the decided improvement in the heavy industries, of which lumber is one.

There are lags, of course. Particularly in employment and reemployment. There is also a very definite lack of public confidence in certain industries, despite recent increased demands for their products. This is serious. It constitutes a real challenge to industry, particularly to one founded on a natural resource which is vital to the common welfare. For to such an industry, success is very definitely contingent upon wide public confidence which must be extended to the industry as well as to its products.

The social and economic welfare of the United States is dependent to a measurable extent on continuous production of forests and harvesting of tree crops. Migration of forest industry labor is unnecessary if proper methods are followed. To me it is unthinkable that a major industry should continue practices that do not help build up the common welfare. I am convinced that this can be done, with profit to the industry in the long run.

I am also convinced that progressive leaders in the lumber industry realize this situation. I believe, particularly after meeting with them at the Western Forestry and Conservation Association's conference in Portland, that they see the vital necessity for such changes in industry management and practices as will create and build up that confidence. Certainly without it, public assistance which the lumber industry needs,—in the form of state and federal legislation, by way of example,—will be far more difficult to get.

Forest lands constitute, today, almost one third the total land area of the continental United States. They have a direct and vital effect on the social and economic welfare of the Nation. This is one reason why the common interest inevitably extends to all forest lands, including that great bulk of the most valuable ones which are still in private ownership. Public determination that forest lands shall be kept continuously productive, and that they shall be so managed that they may contribute with security and stability to the support of their fair share of the Nation's population, is therefore both logical and justifiable.

There should be no doubt within the lumber industry about my attitude in this whole matter. I have clearly stated it, on many occasions, as one of helpful cooperation in an earnest endeavor to solve problems which are common to the lumber industry and the public interest. You know that I am convinced there is a very definite social obligation inherent in private ownership and operation of forest

lands, and that I recognize the worth of those measures which, undertaken by the industry under Article X of its Code, are essential to adoption of that sustained yield management which I believe will redeem the industry's social obligations.

You know, too, that I am convinced of the fact that as the public interest extends to privately owned forest lands, so also does public responsibility. Evidence of this conviction is not lacking. I have consistently urged constructive C.C.C. work by the federal government on private forest lands. On the basis of replacement under normal conditions, accomplishments which contribute on these lands directly to fire protection alone have already reached the sizeable total of 75 million dollars. The accelerated federal acquisition program brings to private owners cash payments of around 25 million dollars for approximately 8 million acres of forest lands. This relieves these owners of substantial cash outlays for carrying charges. Research, in such federal matters as the Forest Survey and the work of the Forest Products Laboratory, has already contributed materially to the lumber industry.

These things are in addition to federal assistance through Clarke-McNary funds for cooperative fire protection. These funds have totaled more than $1,500,000 annually in recent years; up to June 30, 1935, they had reached the very respectable cumulative total of almost $17,500,000. And I think it is only fair to say that aggressive efforts by the Forest Service had much to do with President Roosevelt's expressed desire that governors critically analyze the forest land tax situation which—clearly within state jurisdiction—is vigorously asserted by lumbermen to be a major factor in quick liquidation and tax delinquency of forest lands. The Forest Service has also encouraged Reconstruction Finance Corporation loans to facilitate forest practice.

You will, I am sure, recognize that efforts on my part to gain additional public support for measures which will help stabilize the lumber industry will be handicapped unless that industry is willing to continue previous commitments and undertake additional constructive measures to redeem its own social obligations and responsibilities.

These in brief are my reasons for urging the lumber industry to continue its fire prevention and protection measures and others which will help to leave cut-over forest lands productive, and to accelerate progress toward sustained yield forest management. For if these measures are continued unabated, and an earnest effort is made to apply sustained yield management to operating economic units, both public confidence and additional public assistance to help stabilize the lumber industry will the more clearly be justified.

I feel, too, that there is vital need for the lumber industry to provide a permanent set-up which, independent of individual concerns or regions, will be in position objectively to examine industry problems in relation to its and the public's conservation problems. A permanent agency under such a set-up should be invaluable, particularly in industry relations with state and federal governmental conservation agencies. It should add materially in a real effort to build up public confidence.

Sincerely yours,

F. A. Silcox,

Chief, Forest Service.

The Reflecting Crownmeter

An elaboration of an instrument known as the reflecting crownmeter, in use at Dehre Dun, India, has been successfully used since November, 1935, at the Mt. Toby Forest of the Massachusetts State College at Amherst, Massachusetts. The instrument has been used for an accurate

measurement of crown widths of trees up to 100 feet in height.

The instrument consists of a 5 x 7-inch mirror on the back of which has been scratched a center line in the direction of the shorter axis. The mirror is centered on a light piece of wood 6 x 8 inches and ½-inch thick, on which is placed a small metal spirit level. The level is fastened to the wooden base midway on its longer side, at right angles to the center line on the mirror. The mounted mirror is attached to a four-foot Jacob staff by the universal joint of a staff compass. The staff is made perpendicular by a second, circular spirit level fixed to it at a convenient distance beneath the mirror. The staff is also equipped with an iron point so that it may be pushed into the ground with little difficulty. An iron cleat better facilitates this and is attached to the staff about 6 inches from the bottom.

Two sights, each centered on the small ends of the board, project sufficiently high above the mirror so as to allow alignment of its longer axis with the radius of the crown being measured.

In operation, a 50-foot tape is laid on the ground, preferably in a north and south or east and west direction, from the bole of the tree to a point beyond the edge of the crown. The staff is set up perpendicularly on the ground at a point next to the tape, approximately beneath the edge of the crown, and the mirror is accurately levelled and aligned parallel to the tape. This is a trial position, but a glance in the mirror enables the operator to know if he must move towards, or away from, the tree for a second attempt. With a little practice this ability to set up beneath the crown so that the crown permiter falls on, or very near to, the center line of the mirror is readily acquired. Since the center line of the mirror is in the same plane as the center line of the staff, the position of the crown edge in the mirror may be established by aligning the pupil of the eye, the mirror cross-hair, and the crown edge. The radial width of the crown is then read directly from the tape on the ground. A similar procedure is followed to secure as many measurements of additional radii as may be required.

Justification of the accuracy used to measure crown widths in such detail is based on the nature of the study for which the reflecting crownmeter is being used. Its purpose briefly is to trace as

Fig. 1.—The reflecting crownmeter in operation, showing the tape on the ground, foot cleat on staff, socket attachment, circular and longitudinal spirit levels, and one of the two sights on the perimeter of the mirror. Tilting of the mirror facilitates the location of the crown reflection, but since the mirror is levelled in the radial plane, a true image is recorded.

accurately as possible the subsequent development of the crowns of white pine (*Pinus strobus* L.) following a 2-cut shelterwood cutting. One important phase of the work is to measure two diameters, one in a north and south direction, the other in an east and west direction. No attempt will be made to plot actual crown projections, either vertical or horizontal, but the determined points on the above lines will be used to form rectangular-shaped figures whose medians are the measured crown diameters. Later measurements, taken along the same radii as were initially used, will give similar, larger figures, representing a comparable increase in crown area. If possible, this increase in crown area will be correlated with diameter growth. It is hoped the results of the study, extended over a reasonable length of time, will permit operators to better estimate which trees can be profitably left in shelterwood cuttings, from the general appearance and shape of their crowns.

The reflecting crownmeter, as outlined above, is easily constructed and may be used after a little practice with a reasonable degree of speed. In trial operations no difficulty was experienced in the case of interlacing crowns of adjacent trees, both crown edges reflecting clearly enough to be easily recognized in the mirror.

Carefully repeated check measurements of crown widths by different people show that variations in measurement do not exceed one inch.

R. P. Holdsworth,
James D. Curtis,
Daniel McCleary,
Mass. State College.

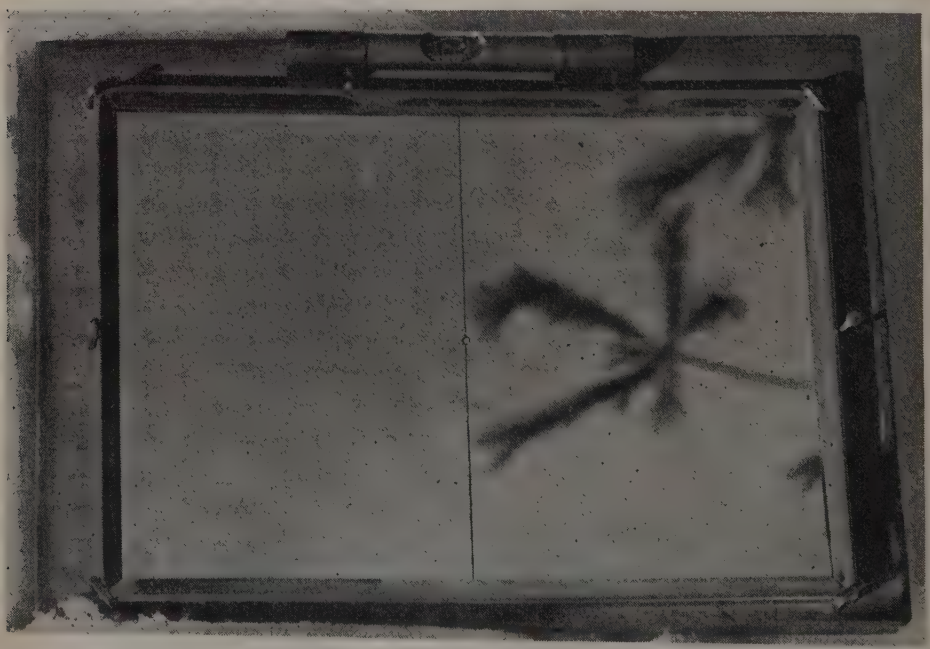

Fig. 2.—The appearance of a reflected branch tip when a crown radius is measured, showing the bubble of the longitudinal spirit level "centered," and the cross-hair of the mirror tangential to the tips of the needles of the furthest extending branch.

A Proposed Purchase Unit in Paloduro Canyon, Texas

The first field job participated in by H. H. Chapman for the U. S. Forest Service was a report on the Paloduro Canyon in Texas, near Amarillo, in 1904. This white elephant of 30,000 acres belonging to a land and cattle company comprised a rugged, arid canyon at the headwaters of the Red River. Being of no value even for grazing, the company sought some way of getting it off its hands by public acquisition. The Forest Service was persuaded to undertake this examination by George L. Clothier, '03, whose optimism as to the possibilities of tree growth on the prairies far exceeded, in fact completely distanced, all recent developments in that line. Hence the report by Chapman, who did *not* recommend planting or other forestry operations.

The efforts to foist this tract off on the federal or state governments continued unremittingly without success until very recently, when the only possible use of the area was recognized, namely for a scenic park, for which it possesses outstanding advantages. However, the actual value per acre for this purpose, on any national basis, was extremely low.

The owners were successful, on this basis of park use, in inducing the state of Texas to buy 15,103 acres of the Canyon on July 1, 1933, for $25 an acre, or a total of $377,575, for a State Park, and this Park was developed through four C.C.C. camps. Eight miles of graded road have been built and a stone house constructed on the rim, under the National Park Service. As to price, the highest value for fertile ranch property was $25 and is now about $5, but the Canyon for this purpose was not worth 25 cents per acre.

Now the owners desire to work off the remainder of the tract for a National Forest Purchase Unit. Chapman's report showed that it took 100 years to grow a 4-inch cedar fence post. The forest examiner said when he learned of this early report, "Too bad that all this work was not directed at a more likely region." It took Chapman about one day to reach this conclusion in 1904, but the work had to go on, and was completed as per plan. Even fuel-wood production is of no value in the Canyon in competition with natural gas at Amarillo.

In spite of these facts it is understood that a United States Senator from Texas advocates the establishment of a purchase unit in this Canyon, and is critical of the adverse report made by the forest examiner. When and if politics dictates purchases and prices for National Forest units, we will enter a new era in forestry not promising for the future economic integrity of the Service.

H. H. Chapman,
Yale School of Forestry.

Black Ash

Dr. Jacob Breid, former superintendent (1920-1934) of the Sac and Fox Indian Sanitarium at Tama, Iowa, was vitally interested in conservation. The Indians under his charge used and demanded black ash (*Fraxinus nigra*) for basket making. The continued tourist trade in baskets led to an exhaustion of the black ash stock on this 3,800 acre reservation. Dr. Breid was unsuccessful in his endeavor to secure black ash planting stock. The Wisconsin band of the Winnebago Indians were also finding it difficult to secure sufficient black ash stock for their basket work.

It was proposed to use pulled wild stock collected in the northern part of the Lake States, and ship it to Iowa for planting. However, the lack of funds precluded such use.

A black ash planting project was suggested in the autumn of 1934 by Superintendent Frank Christy, of the Tomah Indian School, Tomah, Wisc. The trees were to be planted on school grounds in soil that seemed particularly well adapted to this species. Superintendent Christy secured from a local resident 11,000 "wildings," some up to 3 feet in height These were used in planting 11 acres at an approximate cost of $60 per acre. The growing season of 1935 was especially favorable for this planted stock; over 90 per cent of the trees survived.

In January, 1935, I met in the Washington Office of the Indian Service Dr. E. A. Bates, of the Extension Division, Cornell University, who discussed the need for further cultural research work with black ash. During 1934-35 a series of experiments was carried on at Cornell University by Mr. George S. Meagher, a graduate student working under the supervision of Prof. J. Nelson Spaeth. The material used consisted of root, hardwood, and softwood cuttings. The results were entirely negative.

Correspondence with the Lake States and the Northeastern Forest Experiment Stations revealed that the subject had been given little attention because of the small demand for the wood. The property of being easily separated (cleavability) into thin layers and bending without breaking makes black ash valuable for use in basketry. Black ash has been used by a few firms in Michigan for veneer, and it also makes excellent fuel wood.

It was decided by the Indian Service to collect wildings in the spring of 1935 on the Red Lake Indian Reservation, Minn. These were set out in nursery transplant rows. In all, 28,000 were pulled, at an average cost of $13 per thousand. An interesting thing was that the Indians, who had lived in the forest all their lives, collected quite a large number of elderberry and green ash plants which they mistook for black ash.

The wildings were pruned to 20 inches in height, their diameter averaging ⅜ inches. After pruning, they were transplanted in rows 10 inches apart, spaced 6 inches in the rows. Some of the stock remained "heeled in" all summer. The water table was regulated by a dam across Pike Creek below the nursery, resulting in growing conditions approaching optimum for this species.

The total cost of the black ash stock, including pulling, heeling in, planting cultivation, digging, sorting, and packing, amounted to $15 per thousand. The trees were then transported by truck to the Sac and Fox Indian Reservation, Iowa, where 8 acres were planted two thousand to the acre at a total cost of $46 per acre; and to the Winnebago and Omaha Reservations, Nebr., where 2½ acres were planted at a slightly higher cost. There is every indication that a fair survival may be expected.

The Winnebago Indians, former residents of Wisconsin, are excellent basket makers. The Omahas do not use black ash. The Nebraska plantations received most favorable comments from the Indians, who had to secure their basket wood from Wisconsin at considerable expense and great inconvenience, and often received it in a partially dried condition, which necessitated additional work in the preparation of splints.

In the autumn of 1935 approximately 75 pounds of black ash seed was gathered at a cost of 30 cents per pound, and following calcium hypochlorite treatment was stratified in peat and stored at an average temperature of 35 to 40 degrees. Five pounds of seed were sent to Cornell University for experimental purposes and germination tests, and one pound was sent to the Lake States Forest Experiment Station for germination tests. The Soil Conservation Service, Ames, Iowa, gratuitously sent the Red Lake nursery 40

pounds of black ash seed, which on receipt was found to be infested with an unidentified weevil that had destroyed quite a lot of the seed. As no weevils of the same kind were known to exist in that section, the seed was destroyed.

Brief notes on the manufacture of black ash baskets may be of interest. These are based on hearsay rather than actual observations. However, it is believed they are substantially correct.

The black ash trees selected are 3 to 4 inches in diameter, free of large knots for a usable length. The trees should be alive and are ordinarily cut during the growing season, when the sap is up.

The round stick is barked and then beaten thoroughly throughout its entire length with a wooden hammer or mallet, in such a manner as to loosen the annual rings of growth. These are stripped off with an axe or knife. The loosening and peeling of the layers is continued until a core is reached which does not easily separate. This core is used for basket rims or handles or is thrown away.

The strips removed are of nearly uniform thickness, although they naturally vary with the rate of growth. The width of the strips peeled is variable.

The strips are next split to uniform widths, and sometimes to thinner strips. The surfaces are smoothed with a special knife, and are then rolled to be stored until needed. I understand they are sometimes stored in the snow. Prior to basket weaving, the prepared strips are soaked in water to make them pliable. If desired, they are colored with dyes at this time. Weaving is checkerboard fashion or some variation of it. The designs are simple. Some baskets are elaborated with twisted or bent strips forming a border.

The baskets, either with or without lids, are sturdy and durable and may be used for countless purposes. The Indians have no difficulty in disposing of all the good baskets they make.

WILLIAM HERITAGE,
Lake States Region,
Office of Indian Affairs.

NOTE ON SEED GERMINATION OF EUROPEAN MOUNTAIN ASH

Within the last few years wildlife management has come rapidly to the fore, and more recently, with it, an interest in the propagation of plants which are valuable for food and shelter of wildlife species. This has brought the forester many new problems of seed storage and treatment and nursery procedure, since many of these plants have been seldom or never propagated in forest nurseries. One tree species so esteemed is the mountain ash, and in view of the similarities between the European and American species it has been considered of interest to summarize a German paper[1] published in 1931, by L. Fabricius.

In Bavaria mountain ash, while recognized as providing food for various birds and mammals, is valued also as a nurse crop for pine and spruce on clear-cut areas. Since some difficulties in growing the species arose, the Munich Institute of Silviculture and Forest Utilization undertook some tests to determine the best methods for seed and nursery treatments. Since it had been noted that seed which had passed through the digestive systems of birds commonly germinated well, one set of tests was run to determine whether or not the seed dormancy was due to an impermeable seed coat. Whole berries,

[1]Die samenkeimung von Sorbus aucuparia L. (Seed germination of Sorbus aucuparia L.): By L. Fabricius. Forstwissenschaftliches Centralblatt 53 (12): 413-418. June 15, 1931.

crushed berries, macerated berries, and clean seed all were treated for various durations and degrees with water, hydrochloric acid, sulphuric acid, nitric acid, urea solution, the gastric juice of birds, and its various components (hydrochloric acid, pepsin, and pancreatin) in various combination. No germination resulted from any of these treatments alone. Another test to show the effects of temperature and light on the germination of mountain ash seed showed that low temperatures (in this case the seed was exposed for 112 days to outdoor winter temperatures, the lowest being —15° C. or +7° F.) induced good germination provided the seed were not exposed to the light. Seeds exposed to light gave practically no germination despite the fact that they were subjected to the same low temperatures. These tests also showed some sources of seed to be much better than others, from the germination standpoint. Clean seed was superior to that in the berries, in all tests.

Recommendations based on these tests are to fall-sow clean seed for the best results.

Nursery experiments conducted by the Bavarian Forest Service led to the use of the following methods: The fresh berries are crushed in a fruit press, or mashed for several days in water and then crushed as soon as they begin to ferment. The mashed material, freed from juice and water, is rubbed to pieces, strewn over the seed bed, and covered not over 1 to 2 mm. with sand or sifted soil. Fall sowing is used both in the nursery and for direct seeding in the field. 2-0 seedlings or unusually well developed 1-0 seedlings are sometimes used for field planting, but as a general rule 1-1 transplants are preferred.

PAUL O. RUDOLF,
Lake States Forest Exp. Sta.,
U. S. Forest Service.

PERMANENCE IN PINE

Clear acknowledgment of timber growing as one of the pillars upon which the future of the Southern Pine Association rests was contained in an address delivered by H. C. Berckes, Secretary-Manager, at the 21st annual meeting of that Association in New Orleans. The keynote of Mr. Berckes' talk was *permanence.* The following extracts from his address will interest and encourage members of the forestry profession:

"Is ours a transient and dying industry, or is it a living and progressive one? The answer is that its greatest possibilities are in its future, not its past. The measure of this future success is dependent upon confidence in our permanence, clarity of our thought, and the firmness of our purpose.

"The erroneous thought that our industry was impermanent has plagued our steps for many years. It has confused our thinking, it has sapped our courage and made difficult the orderly and profitable marketing of our product. Study and experience have dissipated these mistaken ideas. Permanence in our industry is of a three-fold nature. It lies not only in our timber supplies, but in our institutions and in our markets. By institutions I mean not only our Associations, but our producing facilities as well. Institutions and markets cannot be maintained without timber supplies, and timber supplies are useless without institutions and markets.

"Under the Lumber Code our industry assumed certain obligations with respect to forestry and conservation. With the passing of the code we continued our forestry department, which has justified its existence if for no other reason than that it has *proved* the permanence of our supply of Southern Pine, and made possible the impression of that fact upon manufacturers, distributors, specifiers, and

consumers of our products. In our exhibits and our reports we develop this thought to your satisfaction. The Association for many years has conducted in the newspapers and other periodicals throughout the country a campaign of education as to the availability of southern pine. The results of this work have been evident in the changed attitude of the public toward our industry and the realization on its part that the southern pine lumber industry is permanent.

"With the assurance of an adequate supply of raw material, our manufacturing and Association facilities assume permanency. It is true that individual mills will come and go, except the increasing number of those which are being established upon a sustained yield basis. But we must conceive of the manufacturing facilities as a whole, and work for the kind of improvements which permanency makes possible."

Mr. Berckes recommended that all possible service be given to operators who desire to grow southern pine and harvest it efficiently. This keynote of a permanent timber supply, to be manufactured so far as possible in permanent plant communities and distributed with increasing usefulness to permanent markets, is an expression of the controlling opinion in the industry. As such it is highly significant, indicating that the objectives described by foresters during the last twenty years and declared more recently in Article X of the Lumber Code and its supplements are definitely sought by the southern pine industry.

During the course of the three-day session in New Orleans, there was held a meeting of the Conservation Committee, attended by twenty-eight operators and several technical foresters, and given over to serious discussion of the problems of forest management and matters of national policy. It is evident that the Southern Piners are well satisfied with their Conservation Department.

JOHN B. WOODS,
National Lumber Manufacturers' Association.

EFFECT OF GROUND COVER ON GROWTH RATE OF LONGLEAF PINE SEEDLINGS

In a 15-minute talk given at the meeting of the A.A.A.S. at St. Louis, L. J. Pessin, of the Southern Forest Experiment Station, gave the results of an experiment in which a dense stand of 100,000 seedlings per acre already 12 years old was freed of competition of other vegetation.

In the first series all plants were removed except pine seedlings, which were thinned to the desired density. In the second series all trees except those selected were removed; the ground cover was otherwise left undisturbed. In the third series the ground cover and scrub oaks were left undisturbed, and the pines thinned. After three growing seasons, the increase in growth of seedlings in the first series ranged from 64 to 1,066 per cent, depending on density of stocking. In the second series, the increase was 46 to 227 per cent; in the third series, only 27 per cent. These results indicate that ground cover, consisting mainly of the piney-wood grasses, and often scrub oak, offers keen competition to young pine seedlings.

The conditions created by this experiment, both of reduction of other vegetative competition and reduction of numbers of the pine, can be secured by the practice of controlled winter burning, though this method was not used in the experiment nor mentioned in the review. Hand labor is an impractical method of eliminating competition in natural stands of longleaf pine seedlings.

H. H. CHAPMAN,
Yale School of Forestry.

R. E. Benedict

Raymond E. Benedict died at Waycross, Ga., the evening of March 19. He had been in poor health for the last two years. The immediate cause of his death was uremic poisoning.

Benedict was one of the crusading band of young foresters who, in the first decade of this century, under the leadership of Gifford Pinchot and President Theodore Roosevelt, pioneered for the Forest Service. His first appointment was as Student Assistant, in the summer of 1900. Thereafter he was continuously with the Division and Bureau of Forestry and the Forest Service until his resignation in 1912. In 1904 he was Forest Assistant; in 1905, following the transfer of administration of the "forest reserves" from the Interior Department and the organization of the Forest Service, he was appointed Forest Inspector; and in 1907, when the six National Forest Inspection Districts were inaugurated, he was put in charge of District 3 as Chief Inspector.

After organizing this District he became General Inspector attached to the Washington Office for a year. Then followed nearly four years of service as Forest Supervisor of the Olympic National Forest. He resigned to take part in the organization and development of the Forest Branch of British Columbia during the five years prior to the entrance of the United States into the World War.

He served with the Tenth and Twentieth Engineers (Forest) receiving at the outset a major's commission and ending as lieutenant-colonel. From France he received the decoration of the medal of the Legion of Honor. For the past ten or twelve years he was in partnership with M. L. Rue. He has been manager of the Brunswick-Peninsula Company forest properties in southeastern Georgia, with headquarters at Brunswick.

Benedict was one of the older members of the Society of American Foresters. He was elected to membership in 1905. In 1933 he was Chairman of the Southeastern Section. He had a wide circle of friends, for he possessed not only a genius for friendship but also a character ennobled by high ideals.

M. S. Benedict, Supervisor of the Caribou National Forest, and M. A. Benedict, Supervisor of the Sierra National Forest, are his brothers.

REVIEWS

Professional Forestry Schools Report: Giving the Comparative Status of those Institutions that Offered Instruction in Professional Forestry for the School Year 1934-35. By H. H. Chapman. *xiii + 174 pp. Society of American Foresters, Washington, D. C. 1935. Price $1.50.*

This concise report is an excellent piece of technical workmanship in the difficult field of measuring the tangibles and intangibles that constitute the quality of a forest school. Like all efforts to measure the imponderables of the human spirit (and the essence of any great human institution is essentially spirit rather than physical equipment) this evaluation of the forest schools is not to be interpreted as absolute. Nevertheless, the result gives a workable guide for prospective students, for the schools themselves to steer by, and for the profession.

The historical events that led to this study are interesting. It was in 1927 that Raphael Zon, in a bold editorial in the JOURNAL OF FORESTRY that caused a considerable stir and some hurt feelings, attacked the weaknesses of forest education in the United States and urged a grading of the forest schools similar to that made some years ago in the medical schools.

As a result of the heated discussion that arose from Zon's editorial, the Society undertook a study of forest education in the United States with the help of a grant of $30,000 from the Carnegie Foundation. The study was in charge of Dean Henry S. Graves of the Yale School of Forestry, assisted by Prof. Cedric H. Guise of the Department of Forestry of Cornell University, and in 1932 they published at the Yale University Press their authoritative and widely known "Forest Education." They did not, however, attempt a definite rating of the schools.

In 1933 the Executive Council finally undertook a grading of the forest schools, which was concluded in September, 1935, and which has now appeared in the form of Professor Chapman's book.

Briefly, the results of this classification were to qualify fourteen forest schools for approval as professional schools. Six other institutions were partially approved as covering the general field of professional forestry, but not fully meeting the standards required for approval.

It is the methodology used by Chapman in his complicated study that deserves admiration, even though it may meet with dissent and criticism. Seven factors, tangible and intangible, were chosen for measurement as reflecting the quality of the schools. The weight given to each of these elements was determined by averaging the weights proposed by twenty-four schools of forestry. These factors and weights are as follows:

1. Departmental status	6
2. Faculty, or provisions for instruction	16
3. Personnel of faculty	24
4. Financial support	17
5. Equipment	12.5
6. Field instruction	12.5
7. Historical and alumni	12
Total	100

Each of these in turn, except No. 1, was broken down into smaller elements

susceptible in most cases of more or less accurate measurement. Most easily measurable are Financial Support and Equipment. The latter, for example, was broken down into (a) buildings—floor space and character; (b) library equipment; and (c) laboratory equipment. Each of these can be accurately assessed and minimum standards can be set. The total weight of 12.5 is not excessive in a rating based primarily on quantitative elements, and any bias toward overemphasizing physical equipment would, in any event, be at least partly overcome by the relatively high weight (24) given to Personnel of Faculty. Faculty, or Provisions for Instruction, was broken down into (a) number of full-time teachers and equivalent; (b) average load of teaching; and (c) provision for research. Personnel of faculty was broken down into (a) years of experience in study, in practice, and in teaching; (b) activity as authors or producers; (c) reputation as teachers.

It is clear that all three elements under Faculty, or Provisions for Instruction, are reasonably susceptible of quantitative measurement, though most assuredly the qualitative element enters into (c) provision for Research, as one can immediately raise the question, "What kind and what calibre of research?"

Personnel of faculty is, on the contrary, bristling with qualitative elements. Thus a large possible differential enters into measuring experience in study, in practice, and in teaching, owing to the widely variable quality of the institutions in which the experience was accumulated. This differential was partly, but not wholly, offset by reducing the credit for teaching experience if that experience was gained in an undermanned school with excessive teaching loads. Activity as authors or producers was measured purely quantitatively in number of technical books, articles, and bulletins, without attempting to evaluate the tremendous variables of technique and intellectual penetration displayed by the output. It is well known to the readers, the editors, and sometimes to the authors of scientific literature that output may range almost anywhere from practically pure rubbish to pure gold, and that in many cases the least prolific producers may have the greatest influence on the development of a profession.

Nevertheless, the author might properly claim that the weakness of quantitative measurement of these two categories is partly neutralized by the assessment of "Reputation as teachers." On this point, he took special precautions, using two separate tests. To quote him:

"In the first, each school was separately rated by the twenty-three other institutions, the average of whose opinions was taken as constituting the professional reputation of the school. In the second, the authors of 'Forest Education' consented to rate the schools on this point, on the basis of their previous study, which had not included such rating. The results of these two independent ratings were in substantial agreement, and the rating in turn was practically identical with that obtained wholly on the basis of the tangible factors of physical equipment and financial support."

Even these precautions do not, of course, guarantee against the possibility of subjective feeling entering into both ratings. Yet the correction of such subjective influences would entail a vast amount of work and probably still lead to unsatisfactory results. If we could have a competent mental test for each member of the faculty, supplemented with a detailed evaluation of the *quality* of his total experience, plus critical evaluation of his scientific writings, we might more accurately grade "reputation"; but we would still have to allow for the immeasurable idiosyncrasy of human character. When we attempt to measure men,

we should remember what some one said of Beethoven, that if he had been given a mental test at the age of nineteen or twenty, when his deafness first began to appear, he would have been advised to give up music and to become a shoe salesman.

Even in Historical and Alumni the final output of the schools, namely their graduates, was pretty accurately measured by distinction achieved as reflected by salary and position. Since the purpose of a higher school of learning is to turn out well educated and intelligent men for leadership in human affairs, one might well raise the question as to whether a greater weight should not be given to the distinction achieved by its alumni. In truth, the principal weakness of this report lies in the fact that 85 per cent of the total grade is made up of measurable quantitative factors and only 15 per cent given to the imponderable qualities of efficiency of teaching staff and distinction of alumni. This very low weighting of the imponderables was partly due to the recommendation of the Education Division of the Society that the rating be confined wholly to purely quantitative factors and partly, no doubt, to the inherent difficulties of evaluating intangibles.

The emphasis laid by this reviewer on this aspect of Chapman's study is in no sense of the word a detraction from an unusually thorough and fine piece of work. It is intended, on the contrary, to draw attention to the possibilities of further research into and refinements in the rating of those higher qualities of mind and spirit that ultimately determine the difference between great teaching and mediocre. European educators have frequently commented on the striking disparity between the physical grandiosity of our educational institutions and the average quality of their output. It is suggested, as an experiment, that in the next rating of the schools a much greater weight (possibly 35 per cent) be given to distinction of alumni and an equal weight to personnel of faculty.

The author singles out inadequate budgets for teaching personnel, clerks, and research as the most pervasive weakness in forestry education.

"It is here that the majority of the schools fall down and that the weakest point in the structure of forest education probably is located. When a staff is overloaded with teaching duties and has no provision or time for research, travel, or outside contacts, and no clerical help, the quality of its teaching is likely to suffer."

In addition to the rating, the study includes detailed reports on individual schools and a series of graphic charts on curricula, both of which are valuable for prospective students and for those specially interested in forest education.

All in all, this study, combined with that of Graves and Guise on "Forest Education", is the most valuable contribution made by the Society to the advancement of professional standards. It is the kind of solid work through which the Society "acquires merit" among its members and in the world at large.

WARD SHEPARD,
Office of Indian Affairs.

Logging—Transportation. The Principles and Methods of Log Transportation in the United States and Canada. By Nelson Courtlandt Brown. *327 pp. Illustrated. John Wiley and Sons, Inc., New York. 1936. Price $4.*

It was a rainy day in June of 1934 during reunion week in New Haven when the author, who is Professor of Forest Utilization in the New York State College of Forestry at Syracuse University, and the reviewer discussed the ambitious plan to

put out a new and comprehensive text on Logging. Bryant's classic work on the subject had gone through two editions, but was in need of extensive revision which the author did not wish to undertake. So the discussion turned on how best to divide the subject-matter between two volumes, since to put it all in one volume would make it too bulky.

The result was the appearance, in October, 1934, of the first of the two books: "Logging—Principles and Practices in the United States and Canada." This book dealt with forest utilization down through the felling and preparation of logs for transport. The major portion of the book was given over to an excellent discussion of regional logging practices. This volume was reviewed in the JOURNAL OF FORESTRY for November, 1934.

The present volume takes up where the former one left off—with some unavoidable overlap. It divides into minor transportation and major transportation. Minor transportation includes chapters on animal skidding, tractors, power logging, landings, and loading of logs. Major transportation by land includes chapters on chutes, wheeled vehicles, sleds, motor vehicles, and forest railroads. Major water transportation includes chapters on floating and driving, river, bay, and lake rafts and booms, ocean rafts, flumes, and barges and steamers.

The author has covered the subject completely. He has applied the results of numerous trips to the various sections of the country to effect a compilation which is almost bewildering in its complexity. He drew freely on articles in the trade journals and on the help of various lumber and logging equipment companies and individuals—as indicated in acknowledgments. The pictorial and diagrammatic material is amply illustrative of the text —in fact, it is lavishly abundant.

Perhaps, under the circumstances, it was inevitable that the book should show an uneven treatment in the various chapters. No individual's personal acquaintance with logging operations, and the author's is admittedly great, could be encyclopedic. He was forced to draw on the observations and experiences of others, and to this fact the unevenness of treatment may be attributed.

To be specific, the chapters on tractors, on power logging (cable hauling systems), and on motor vehicles are of outstanding excellence. The chapter on power logging is particularly well written—succinct, clear, and yet sufficiently comprehensive so that even the Eastern tenderfoot can gain from it an adequate conception of the cable hauling systems used in the West.

Perhaps the author overemphasizes the Diesel as against the gasoline engine in tractors. He is certainly "sold" on Diesels—and loses no opportunity to adduce facts and figures to justify his preference. To the manufacturers of tractors his rather "detracting" treatment of the horse in logging may make welcome reading; to the reviewer it seems as if the author is somewhat "motorized," and that the horse does not make quite so unfavorable a showing as the text would seem to indicate.

The chapters on chutes and on sleds are based largely on the exhaustive bulletins by Koroleff and Bryant covering these subjects. The treatment of forest railroads is exceedingly well done, and compresses into reasonably brief compass the essentials of this vitally important means of transport.

The typography and format of the book are beyond praise. The mistakes are remarkably few. The bibliography and index complete and round out a scholarly treatment of the whole subject. The book will fill a need that has long existed in every forest school in the country, but its use will not be confined to the schoolroom and the library. It will, if the re-

viewer does not mistake, be found on the desk of many a logging superintendent and foreman, from the spruce forests of Maine to the Douglas fir of the West Coast. For it brings to the practical operator just the kind of information which he needs, and makes available to him the sources of expert knowledge which the individualism and inaccessibility of most logging jobs have hitherto put out of his reach.

There remains an interesting speculation. Suppose that instead of these two books on logging there had been one. What would it have looked like, what advantages would it have had? "Logging —Principles and Practices" has 284 pages, "Logging — Transportation" has 327 pages, making a total of 611 pages. Before the reviewer is Boswell's "The Life of Samuel Johnson," complete and unabridged in one volume, published by The Modern Library (Cerf and Klopfer) in New York. It is well printed, on good paper. It contains not 611 pages, but double that number—1,200, to be exact. It cost not $7.50 (the price of the two volumes on "Logging") but—here is the most remarkable fact—just $1. This is not to say that Wiley & Sons could be expected to meet any such price; but it does give a basis for wondering whether, on that rainy day in June two years ago, the author and the reviewer were not mistaken in dividing the subject into two volumes. The single volume would apparently not have been too bulky, and would certainly have been less costly.

But that is *un fait accompli*. The important thing is that Brown has given to the foresters and to the forest industries a first-class book on "Logging—Transporation" which will be for many years the authoritative text on this subject. He has performed a difficult task well.

A. B. Recknagel,
Cornell University.

Possibilities of Shelterbelt Planting in the Plains Region. Prepared under the direction of the Lake States Forest Experiment Station, U. S. Forest Service. *201 pp., 105 fig. Gov't Printing Office, Washington, D. C. 1935.*

This bulletin gives the results of a study of tree planting in the shelterbelt zone. Chief Forester F. A. Silcox outlines the problem, after which there are 13 sections or chapters by foresters, scientists, soil experts, agriculturists, botanists, and geologists. These men—experts in their lines —give the most important points, conclusions, and recommendations so that the reader not interested in all of the details of soil, climate, and other factors will find sufficient to have an understanding of the situation.

With the brief amount of space available, the reviewer cannot comment on each chapter; but he desires to call attention to important points brought out. Zon, in the chapter on "What the Study Discloses," makes clear that the general effect of shelterbelts is not the creation of more rainfall over the area covered by tree growth, but the more economic use and conservation of the available rainfall. Shelterbelt planting is not a cure-all of unfavorable climatic conditions in the Plains region. It should be considered as part of a much broader program of water conservation and soil-erosion control tending to hold moisture and to conserve it in the soil.

The section on "Shelterbelt Experience in other Lands," by Rudolf and Gevorkiantz of the Lake States Forest Experiment Station, is most illuminating to the forester who has not had access to the translations of the numerous manuscripts describing Hungarian and Russian shelterbelt planting. The extent and scientific manner in which the Russian tests have been carried out since 1880 is amazing

to the Yankee who thinks of Russia as a backward nation. A government commission was appointed in 1891 which proceeded with a well planned program. Numerous experimental plantations and at least six experiment stations were established. The severe famine of 1921 gave new stimulus to the project. The objective in 1932 was the establishment of 99,000 acres of shelterbelts, and the second 5-year plan called for 865,000 acres of planting, in contrast with a maximum of 1,282,000 for the 10-year program of the United States shelterbelt. A review of the Russian project would come as a shock to those who have the idea that the United States shelterbelt is visionary.

The climax to this reviewer is the chapter by Hayes and Stoeckeler on the "Soil and Forest Relationships of the Shelterbelt Zone." They speedily cast aside the fantastic idea of the unfortunate early publicity of the shelterbelt by stating that tree belts cannot be created in any geometric pattern of uninterrupted equidistantly-spaced lines, but will have to be arranged more in accord with the dictates and habits of nature. They estimate that, in the 115,000 square miles of the shelterbelt zone, 56 per cent of the soil is favorable for planting, 39 per cent difficult, and 4 per cent unfavorable. They believe that much unfavorable area can be successfully planted if the proper species are chosen, if the ground is prepared carefully, and if water conserving measures are adopted.

They show, for each soil type from the north to the south boundaries of the zone, what may be expected in the way of tree survival and growth, and which soils should be avoided. This is not mere theory, but is backed up by graphs showing the root systems of trees that were measured for many of the soil types.

Aikman completes the picture with a chapter on the "Native Vegetation of the Region." There are 141 species of trees and shrubs in the shelterbelt zone. Four trees—sandbar willow, cottonwood, box-elder, and chokecherry—occur throughout the entire area, and six more—eastern red cedar, peachleaf willow, American elm, hackberry, green and prairie ash combined, and wild plum—occur practically throughout.

This publication is a monumental work on the subject. It effectively answers a lot of unwarranted criticism and definitely establishes this as a well planned, scientific project meriting the support of foresters and agriculturists. Whether the shelterbelt continues or is cut off, this volume will stand as an authority on the Plains Shelterbelt Project for years to come. If the recommendations contained therein are followed, there is no question but that successful shelterbelts can be established that will help to control wind erosion, which this spring is again darkening the skies of the Plains region. If we follow the hit-or-miss planting methods of the past, such as one critic recently advocated, survivals no greater than 30 per cent, which is the estimate in the bulletin for the past 50 years' work, will be obtained. This bulletin justifies the faith of our forest-minded President in the Shelterbelt Project, and if it is discontinued now I have no doubt but that we will later return to an organized program just as the Russians did on two occasions.

From the craftsman's standpoint, the bulletin is one of the best jobs ever put out by the Forest Service. Large-size sheets of a good grade of paper are used, and there are numerous excellent illustrations, charts, and maps. The only error noticed was the spelling of the name of the late Congressman Moses P. Kinkaid, who for 20 years represented the sixth Congressional District, comprising the western half of the state of Nebraska. Through the authority for distribution of trees which he induced Congress to add

to agricultural appropriation bills, starting with 1912 and ending in 1927, 2,449,000 trees were distributed to 12,663 people; so that Mr. Kinkaid was really the percursor of the Clarke-McNary tree distribution.

FRED R. JOHNSON,
U. S. Forest Service.

Forest Planting on Michigan Farms. By R. H. Westveld and J. L. Van Camp. *Michigan State College Extension Bull. 147. 44 pp. 1935.*

This bulletin is among the first forest tree planting publications to take into consideration the needs of wildlife in its recommendations in the choice of species for planting. In Table 1, the trees for forest planting in Michigan are listed with symbols to indicate their value for lumber, ties, posts, pulpwood, food and cover for birds, and food and cover for deer. Table 2 gives a very good list of shrubs and vines, with symbols to indicate their value for food and shelters for bobwhite, pheasant, ruffed grouse and partridge, Hungarian partridge, and cottontail rabbits.

Several paragraphs are devoted to factors which must be given consideration in order to make a plantation fit successfully into a scheme of wildlife management, "since some birds, animals, and fish are just as truly products of the forest as sawlogs, pulpwood, fence posts, and other wood products." The authors point out that "extensive solid blocks of forest of a single species or age class are not best for maximum propagation of game animals and birds. Variety in the cover is essential. Variation in age and character of the forest can be attained by the use of a maximum number of species planted over a long period of years. Generally speaking, three acres of forest for cellulose production interspersed with one acre of plants for food and shelter should provide a well balanced habitat for most associations of wildlife."

Pure *versus* mixed stands, choice of planting stock, site preparation, care of seedlings, planting methods, cost of planting, and the care of plantations are among the other subjects discussed.

The bulletin is well written and has an effective presentation. It is a much needed publication and should serve as a guide both to forest tree planters who are interested in cellulose production and to those who desire to provide a better environment for wildlife.

JAMES N. MORTON,
Pennsylvania State Game Commission.

Dictionary of Terms Relating to Agriculture, Horticulture, Forestry, Cattle Breeding, Dairy Industry and Apiculture in English, French, German and Dutch. *Compiled by T. J. Bezemer and Associates. vii + 1,064 pp. The Williams & Wilkins Co., Baltimore, Md. 1935. Price $8.*

As the title suggests, the scope of this dictionary is very extensive. About 250 pages are devoted to each language. No definitions are given, merely the translated words. The English terms are perhaps the least satisfactory, and suffer from being chiefly translations of the established terms in the other languages, rather than the accepted English word where such exists. Forestry terms are quite plentiful and form a valuable reference list. Prof. Bezemer was assisted in this compilation by several of his colleagues at the State Agricultural College at Wageningen, Holland. Apparently there were no collaborators outside of Holland. The

accuracy of the book is therefore all the more noteworthy. Errors are remarkably few. The editor states in his preface that this "is the first dictionary of its kind in this field." There are, of course, several forestry and botanical dictionaries, such as Vocabulaire Forestier in English, French, and German by Gerschel and Fisher 1911, Swedish-English by Deen and Benson, and one in Norwegian, Danish, and German. Prof. Bezemer's book will be most useful in supplementing these purely forestry dictionaries.

HENRY I. BALDWIN,
Caroline A. Fox Research and Demonstration Forest.

Recent Volume Tables for Some Southern Appalachian Species. By L. I. Barrett. *Appalachian Forest Exp. Sta. Technical Note 91. 48 pp. (Mimeographed). 1936.*

These volume tables are the results of a cooperative project participated in by the Forest Service personnel of Region 8 and the Appalachian Forest Experiment Station.

This is the first attempt to present volume tables for the more important Southern Appalachian hardwoods since the publication of the booklet entitled "Volume Tables for the Important Timber Trees of the United States, Part III," which was published by the U. S. Forest Service in 1925.

Owing to the fact that no other tables have been published by the Forest Service, except miscellaneous ones appearing in bulletins dealing with individual species, the 1925 volume tables have had rather extensive use in timber-survey work throughout the East. They have been used by various agencies in the belief that they were fairly accurate.

With the inauguration of the Forest Survey in the delta hardwoods of the Mississippi Basin, it was found that no adequate tables were available for estimating merchantable volumes of the numerous hardwood species found in the Delta. The inaccuracy of existing tables was instrumental in getting James W. Girard to devise a new means of preparing volume tables for hardwoods. The method he employed has already been described in the JOURNAL OF FORESTRY, and is referred to by Barrett.

In preparing the tables shown in this Technical Note, the method developed by Bruce and Schumacher has been used and applied to some 18 species on sites I to III. Two sets of tables are presented, the first based on d.b.h. and log lengths and the second on d.b.h. only, with an assumed average merchantable height for each diameter. The latter tables are based on the same data as the first series, but are to be used for comparatively rough approximations of volume in extensive work.

It is indeed encouraging to see that the Forest Service, through the Experiment Stations as well as the Forest Survey, has finally adopted many of Girard's ideas regarding volume table construction. To those foresters who have to estimate timber in the Southern Appalachians, these new tables will be a real Godsend. It is astonishing that the use of tables based on a fixed top diameter limit has not been more seriously condemned by foresters who have worked in the hardwoods. To my knowledge, the first foresters who consistently objected to the use of these inaccurate and obsolete tables were, besides Girard, the men engaged in the Forest Survey in the South.

A rather cursory comparison between the old and the new tables indicates that the volumes given in the new tables exceed, for the most part, those for the same sized trees as shown in the old tables.

A rough check of several species, including chestnut and yellow poplar, shows that the volumes given by the old and the new tables may differ by as much as 50 to 60 per cent, with the greatest variation in trees above 20 inches in diameter.

It is hoped that foresters dealing with the Southern Appalachian hardwoods will give these tables a severe check, and that after they have proven their worth the Forest Service will find it advisable to recall the tables published in 1925 and then present these new tables in a somewhat similar publication.

G. H. Lentz,
Tennessee Valley Authority.

Park Structures and Facilities. By Albert H. Good (editor) and Associates. *246 pp. Illustrated. U. S. Dept. Interior, National Park Service. 1935.*

This publication will be of unusual interest to all those concerned with the design and construction of forest structures. It contains many worth-while and helpful suggestions of practical value in promoting further improvement in the design of the smaller one-story utilitarian structures, as well as recreational facilities and appurtenances.

Unusual consideration is devoted to designing buildings to be erected of only such materials as will be appropriate to their individual setting and harmonize with the immediate environment. This important phase of the subject, not generally recognized and frequently overlooked, together with the subordination of structures to their natural surroundings, is herein properly stressed. The successful expression of this fundamental principle is reflected in the style and character of many of the structures shown in the illustrations. Everywhere throughout the work is evidenced the effort to work closely and harmoniously with nature, as depicted by the use of building materials indigenous to the locality and fashioned after the manner of the craftsman rather than the mechanic.

To design buildings for public use and convenience which will be harmonious with their particular locations and not intrusions, buildings which are evident yet not conspicuous, is a highly specialized problem requiring the utmost skill and rare good judgment for its achievement. This is especially true of those structures which are to be located amidst awe-inspiring scenery of the rarest natural beauty.

The development of our country's vast natural tracts, such as the National and State Parks, presents a new problem, in which the designer can proceed, untrammelled by precedent, to work out delightful solutions of this new type of architecture. The design for structures of this type must, of necessity, be simple and natural; quite the reverse of the sophisticated modern or other traditional styles of a highly detailed and academic character. Obviously, the geometric and mechanical character of the modernistic style, so prevalent at present, would be strangely out of place amidst the beauties of nature.

In this volume there will be found many noteworthy examples of the successful treatment of this problem, which in the absence of any established precedent or traditional style is unusually difficult of solution. In this respect, the architecture of the various structures affords an interesting and refreshing contrast to the problems of urban localities in that there is no well defined prototype to follow.

Another invaluable feature, the importance of which should not be underestimated, is the explanatory text and descriptions accompanying the various illustrations. Plans, elevations, perspectives,

pictures, etc., no matter how interesting, are of little or no practical value if they are incapable of being translated into materials of construction to produce the desired results. For this reason these explanatory notes, setting forth why certain things were done and how effects were obtained and with what success, are frequently of as much service as the drawings and pictures themselves.

This treatise, full of inspiration and helpful suggestions, is an outstanding contribution to a subject which, until very recently, had scarcely advanced beyond the pioneer stage. Its beneficial influence in offering an intelligent, technical method of approach in the solution of many of our forest structural problems will, undoubtedly, be observed for many years to come.

To the collaborators, whose combined efforts are responsible for this unique publication, is owed a great debt of appreciation for the practical, serviceable, and interesting manner in which the subject has been presented.

W. Ellis Groben,
Consulting Architect,
U. S. Forest Service.

American Ferns. How to Know, Grow and Use them. By Edith A. Roberts and Julia R. Lawrance. *viii + 98 pp. Illustrated. The MacMillan Co., New York. 1935. Price $2.50.*

Year-round identification of about 60 species of ferns, including most of those native to northeastern United States and adjacent parts of Canada, is made easy by a key based on the vegetative parts. Simple instructions are given for propagating ferns from the spores and cultivating them in the house and out of doors. Tables show the time for spore collection and the period required for development of various species, and their distribution in the common plant associations. The book is profusely illustrated with excellent photographs. It will appeal primarily to those interested in growing ferns as a hobby or for landscape effect, but it should also be of considerable interest to foresters because so many of the ferns occur in forest associations, and in many places constitute an important part of the subordinate forest vegetation.

W. N. Sparhawk,
U. S. Forest Service.

CORRESPONDENCE

A Five-year Undergraduate Forestry Course?

The following interchange of letters between Dean T. C. Spaulding of the University of Montana and Professor H. H. Chapman of the Yale School of Forestry has been received for publication.

My dear Professor Chapman:

I intend to continue my arguments for a five-year requirement for a Bachelor's degree in forestry. Surely a student cannot obtain a grasp of mensuration without basic work in analytical geometry and statistics. The old days of calling mensuration the mathematical measurement of volume, height, and diameter have long since passed. Your own textbooks, for many years back, clearly substantiate this point. They cannot grasp it.

The capacity of a student to obtain even elementary silviculture or silvics without more than elementary botany is doubtful. Silviculture and silvics, as well as dendrology, are predicated upon plant physiology and plant ecology. Even forest pathology is advisable as a prerequisite, since the instructor in silviculture can then proceed to silviculture without spending a large part of his time in discussing physiology, ecology, and tree diseases. We expect a man to have the elements of forest entomology, also, before he attempts his silviculture.

If the undergraduate schools would go on a five-year basis, Yale, Cornell, and the other postgraduate schools will have a finer and better class of candidates. In other words, we can increase the standards for admittance into the profession. There is another factor, too, that should be borne in mind. Foresters, particularly those entering research, find a need for a doctorate degree. All worthwhile schools offering a doctorate in forestry, or a D.Sc. or Ph.D., require modern languages in sufficient measure that the candidate have a reading knowledge, usually in French and German. The way our undergraduate curricula are outlined makes it almost impossible for the undergraduate to have the modern languages prerequisites out of the way. This is a serious handicap, and undoubtedly discourages Bachelors and Masters of forestry from going further in their academic training.

You have long since struggled for not only a higher standard in the profession, but also stronger curricula, as a preparation for entrance in forestry. Your work of the past year is invaluable. Why not go a step further and insist on an education with forestry, and not technical training alone?

T. C. Spaulding.

Dear Professor Spaulding:

I have the copy of your letter to Westveld and your discussion of the five-year course for a Bachelor's degree in forestry.

When you read my paper presented at the Atlanta meeting you will see that the situation remorselessly points to five years as the minimum required for professional training. I thoroughly agree with your stand that a five-year course should be instituted. In a sporadic discussion entered into by a few representatives of schools at an interrupted lunch, with Jeffers arguing for the five-year course,

it was admitted that the continuance of the four-year course was merely a matter of expediency; but how long will it be expedient for schools to turn out large numbers of young men insufficiently trained on a market that may be flooded within six months if employment under the New Deal does not expand? As a measure for cutting down the number of those graduating in forestry, the five-year course would be the most effective thing that I can think of. It would provide (1) a more basic thorough preparation such as you have discussed, as to the sciences; (2) a more adequate education in economics and cultural subjects; (3) a chance to get the modern languages; and (4) some opportunity to specialize without ruinous elimination of the broad basis which a forester's education should include.

In my mind there are no arguments against the five-year course except to enable men insufficiently trained to seek employment a year sooner than they should in a field in which I believe an adequate number could be furnished who had taken five years.

H. H. CHAPMAN.

Subsequent to and supplementing his letters to Professor Chapman, Dean Spaulding wrote to the Editor of the JOURNAL:

In the past few years I have been more or less passively arguing for an education in forestry, rather than vocational training. Because of the growing complexity of our undergraduate forestry curriculum, we must either lengthen the time required for undergraduate training, or else deprive the student of much of the cultural work he now obtains.

In the "good" old days, the undergraduate, or even the graduate, required only a knowledge of European practice and precept in silviculture, in management and mensuration, and the other basic technical subjects. We in the United States are now developing a fundamental forestry of our own. This has necessitated not only the subjects of yesterday, but in addition their immediate application to our present and future problems. Today the forester must not only know his basic work but also his soils and soil erosion, his wildlife, his range management, the application of statistics and statistical principles, and many other subjects either unknown or unthought-of a decade ago. We must either overload the student, or eliminate all except vocational courses, or add to the length of time.

Forestry curricula have long since been criticised by people conversant with education, because of overloading the student. He may pass his subjects, but he does not digest the subject-matter. Again, we as foresters have been too frequently charged with knowing our own technique but lacking the ability to discuss or intelligently criticize the better things in life; let us say, literature, the arts, the social sciences, and their applications. I charge this against our undergraduate schools. We are not turning out well-rounded men.

Medicine and law are more narrow technically than forestry. Their professions have long since realized that the best type of doctor or lawyer is not one solely trained in the technique of the profession, but one who has a rather extensive cultural training, before he was even allowed to enter his professional curricula. Surely forestry as a profession should be on a plane as high as the two mentioned.

Somebody might be able to suggest other ways of broadening our own profession than by commencing the process while a youngster is an adolescent undergraduate. I can't.

T. C. SPAULDING.

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